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TESTING OF PUREBRED DAIRY COWS.

REVIEW OF THE NEW ZEALAND CERTIFICATE-OF-RECORD SYSTEM IN 1931.

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THE records of milk and butterfat yield included in this survey relate for the most part to cows calving for commencement of test during the calendar year 1930, and to practically all qualifying for certificate in 1931. When the entries were made the effects of the gathering depression were as yet scarcely in evidence, and so far as C.O.R. testing is concerned apparently did not then exist, as the number of cows placed under test showed a decided increase over the previous year. Despite the larger membership a creditable increase in average production was recorded in 1931, and the year was also an exceptional one from the point of view of the many outstanding individual yields authenticated.

The first year of the C.O.R. 305-day test is now completed, and the advent of this class necessitates dividing the present review into two sections. During the year 630 first-class certificates were issued to cows qualifying under the rules for the yearly test, and 107 under those for the 305-day division, so that entries in the latter class represented approximately one-seventh of the total for the year. Some 268 breeders were represented in the year's testing. Of these, 224 made entries for the full-year class, and twenty in the ten months' class, while twenty-four gained certificates in both classes. For the peak month (December) of the year 1930 982 cows were being tested, these being in the ownership of 302 breeders, thus making an average of 3·22 cows per breeder. The corresponding figures for December, 1931, were 637 cows in the hands of 231 breeders, the influence of the depression being conspicuous.

The average butterfat yield represented by the 630 C.O.R. yearly test certificates issued in 1931 was 495·17 lb., as compared with 474·02 lb. for 1930. In comparing these two figures, however, it should not be overlooked that commencing with 1931 the minimum butterfat requirement for cows on C.O.R. test was increased by 35 lb. As a result a number of the lower producers would be eliminated and the average automatically raised. A survey of the records for those cows which

failed to qualify on production under the new standards, but would have been eligible under the original butterfat requirements, indicates that some twenty-eight cows were excluded, there being eighteen Jerseys, one Friesian, six Ayrshires, and three Milking Shorthorns whose final yields lay between the old and the new minimum standards.

(1) C.O.R. Yearly Test Division.

First-class Certificates issued.

The C.O.R. system was commenced in 1912, and from its inception to the end of the calendar year 1931 first-class certificates have been issued to 7,734 cows. Classified under the various breeds, Jerseys are represented by 5,491 cows, Friesians 1,569, Milking Shorthorns 408, Ayrshires 205, Red Polls 60, and Guernseys 1. Particulars of certificates issued during the past two years are given in Table 1. It must be kept in mind that all performances dealt with in this section of the review relate to the yearly test; the C.O.R. 305-day test is dealt with later in the review.

Table 1.

Breed.	1931.			1930.		
	Ordinary.	Repeat.	Total.	Ordinary.	Repeat.	Total.
Jersey	459	44	503	454	54	508
Friesian	74	21	95	78	18	96
Milking Shorthorn..	17	1	18	21	2	23
Ayrshire	11	..	11	13	1	14
Red Poll	2	1	3	2	..	2
Totals ..	563	67	630	568	75	643

Second-class Certificates.

Only thirty-five second-class certificates were issued during the year, or one more than for 1930, showing that around 95 per cent. of the cows qualified for first-class certificate by calving within fifteen months after the date of calving for commencement of test (the rules allow an extra thirty days for second-class certificate). Of the thirty-five second-class certificates gained thirty-one went to Jerseys, three to Friesians, and one to a Milking Shorthorn. The numbers are too small to warrant subdivision into age classes, but the thirty-one Jerseys averaged 452·93 lb. of butterfat, and the three Friesians 565·79 lb., while the Milking Shorthorn yielded 718·38 lb.

Period between Calvings.

The 630 cows qualifying for first-class certificate in 1931 went an average period of 397 days between calvings, while the average for the 643 cows of 1930 was 390 days. Seeing that the maximum allowed is 455 days, it is apparent that the average cow calved well within her time limit.

For second-class certificate the maximum period is 485 days, and here again the average was within safe distance of the margin, the average for 1931 being 461 days as compared with 466 days for 1930.

JERSEYS.

Class-leaders.

With the exception of the junior two-year-olds, the Jersey class-leaders remain as at the close of 1930, when Mr. R. S. Tuck's Ivondale Oxford Lass held the record with a production of 731·29 lb. butterfat. The new leader of the class is Coniston Goldie, bred and tested by Mr. R. Waterhouse, of Ardmore, Papakura, this heifer having advanced the class record to 742·71 lb. Coniston Goldie was milked only twice daily for 308 of the 365 days she was on test. The junior two-year-old class was a particularly interesting one in 1931, there being no less than three heifers which broke the class record, their monthly performances progressing within such narrow limits as to leave the issue in doubt until almost the last month of the test. While Coniston Goldie finally won the senior place, Ashton Olive's Pet, bred and tested by Mr. R. L. Parkin, Bell Block, finished her year with 736·94 lb. butterfat to her credit, and Bridge View Jersey Queen, bred and tested by Mr. A. L. Hooper, Brixton, gained her certificate on a production of 733·94 lb. Both cows were milked only twice daily during the whole of the testing-period. Moreover, the age at commencement of test for the three cows was remarkably close. Coniston Goldie, as will be seen from Table 2, was 2 years 40 days; Ashton Olive's Pet was 2 years 44 days; and Bridge View Jersey Queen exactly 2 years.

The highest yield for the year, irrespective of age, was that of Cytherea's Twylish Cream, a three-year-old bred by Mr. W. H. Wallace, of Huiroa, and owned and tested by Mr. E. J. Clough, of Inglewood. Cytherea's Twylish Cream commenced test at the age of 3 years 331 days, and is credited with 840·41 lb. butterfat. She was milked twice daily throughout the period of test.

The full list of Jersey class-leaders is as follows:—

Table 2.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Coniston Goldie ..	R. Waterhouse, Papakura	2 40	244·5	365	10,759·4	742·71
Senior Two-year-old.						
Ivondale Golden Rainbow	P. J. Petersen, Waitara	2 311	271·6	365	12,962·2	768·46
Three-year-old.						
Ivondale Silver Rainbow	P. J. Petersen, Waitara	3 327	309·7	365	15,073·4	950·63
Four-year-old.						
Keston Flower ..	G. E. Yelchich, Waiuku	4 64	319·9	365	14,679·2	814·95
Mature.						
Holly Oak's Annie..	W. T. Williams, Pukehou	5 9	350·0	365	18,522·7	1,056·49

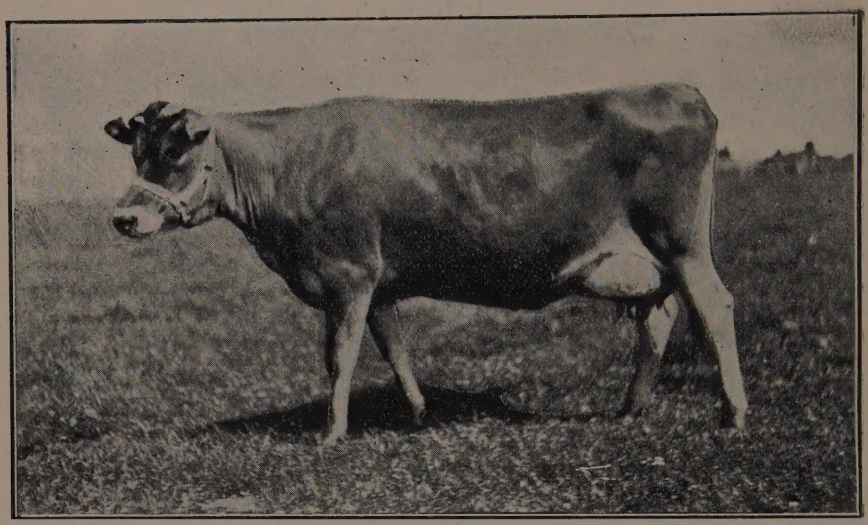

FIG. 1. CONISTON GOLDIE (R. WATERHOUSE, PAPAKURA).

Leader of the Jersey junior two-year-old class: 10,759·4 lb. milk, 742·71 lb. butterfat.

Jersey Class Averages.

During the period under review certificates were issued to 503 Jerseys in this yearly division, their average production being 486·25 lb. butterfat, as compared with 466·78 lb. for the 508 Jerseys certificated in the calendar year 1930. Increases are recorded in each of the five classes into which this breed is subdivided.

The class averages for 1931 and 1930 are shown in the following table:—

Table 3.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1931.		lb.	lb.
Junior two-year-old ..	191	353	7,513·6	427·23
Senior two-year-old ..	62	347	8,070·5	460·11
Three-year-old	66	348	9,046·7	509·36
Four-year-old	49	354	9,657·3	549·56
Mature	135	350	9,914·7	547·49
1930.				
Junior two-year-old ..	200	349	7,273·3	406·21
Senior two-year-old ..	52	342	7,631·7	439·87
Three-year-old	60	340	8,829·0	503·01
Four-year-old	69	342	9,153·3	505·27
Mature	127	344	9,690·2	535·16

The averages, class by class, of all certificates issued to Jersey cows since the commencement of the C.O.R. system are given in Table 4. As might be expected from the marked increase for the year, the average

to date has climbed to a still higher point. The 6,000 certificates mark, and the 450 lb. butterfat mark, have both been passed since our last summary was published.

Table 4.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	2,466	346	7,051·4	394·94
Senior two-year-old ..	663	345	7,763·7	438·49
Three-year-old	921	343	8,471·8	472·78
Four-year-old	626	345	8,981·3	499·19
Mature	1,542	345	9,410·6	516·55
All	6,218	345	8,117·1	451·77
Average test, 5·56.				

Jersey C.O.R. Bulls.

The 5,491 Jersey cows which have received certificates to date were sired by 1,994 bulls. Of these sires 393 are sires of four or more daughters with first-class certificates of record, each daughter being from a different dam, and are therefore entitled to be classed as C.O.R. bulls. Some forty new C.O.R. bulls were added during the year. Three names were added to the champion butterfat bull class, which now stands at *thirteen*. The qualifications for entry in this class, which is a special one inaugurated by the New Zealand Jersey Cattle Breeders' Association, are as follows: Each bull must have five or more daughters (each from a different dam) which under first-class C.O.R. conditions have produced 520 lb. butterfat when starting test up to three years of age, 580 lb. when starting between three and four years old, 640 lb. when starting between four and five years of age, or 700 lb. when five years old or over. (Note.—For cows in the 305-day test the butterfat requirement is 25 lb. less in each case, which is in keeping with the difference in standards for the two divisions.)

FRIESIANS.

Class-leaders.

From the point of view of the Friesian breed 1931 must be recorded as a remarkable year on account of the many fine performances recorded. Credit for outstanding achievement is due to the Piri Land Co., whose test team comprised entries for six out of the seven classes recognized by the New Zealand Friesian Association, and terminated the year's work with the highest record for the year for each of those six classes, one being a 1,000 lb. butterfat record and another a class-leadership. The new class-leader is Totara C. R. Buttercup, a senior three-year-old, whose yield of 989·10 lb. butterfat from 25,885·3 lb. milk exceeds the performance of Manor Beets Daughter 2nd of Ashlynn by 125 lb. butterfat and more than 7,000 lb. milk, the previous record having stood since 1915. The 1,000 lb. butterfat record referred to is that of Totara Sylvia Colantha, the exact figures being 1,024·37 lb.

from 26,310·1 lb. milk in 365 days. This is the seventh New Zealand cow to gain a first-class C.O.R. on a yield of over 1,000 lb. butterfat. Other Piri Land Co. cows which qualified in 1931 are: Totara Veeman Lulu, a junior two-year-old, with 723·36 lb. butterfat (only 17 lb. below the existing class-leadership); Totara K. P. Stella, a senior two-year-old, with 632·09 lb.; Totara K. P. Prudence, a junior three-year-old, with 707·67 lb.; and Totara Sylvia Trixy, a junior four-year-old, with 831·82 lb. This achievement as a whole is unexcelled in our C.O.R. test history. The honour of the highest record for the year for the remaining class, the senior four-year-old, goes to Mr. O. A. Cadwallader, of Greytown, whose Roslyn Princess Fobes gained a certificate for 719·84 lb. butterfat.

Following are particulars of the records of the seven cows which, up to the close of the calendar year 1931, have been granted first-class certificates under the C.O.R. test on yields of 1,000 lb. butterfat or over:—

Table 5.

Name of Cow.	Breed.	Yield.			Age at Start of Test.	
		Days.	Milk.	Butterfat.		
			lb.	lb.	Yrs.	days.
Alcartra Clothilde Pietje	Friesian ..	365	31,312·5	1,145·24	7	357
Holly Oak's Annie ..	Jersey ..	365	18,522·7	1,056·49	5	9
Hilda Minto de Kol ..	Friesian ..	365	27,773·8	1,046·31	12	56
Vivandiere	Jersey ..	365	17,282·1	1,036·09	6	10
Totara Sylvia Colantha	Friesian ..	365	26,310·1	1,024·37	5	229
Pretty's Flirt ..	Jersey ..	365	16,684·1	1,010·49	6	353
Monavale Queen Bess ..	Friesian ..	365	26,461·8	1,002·20	7	363

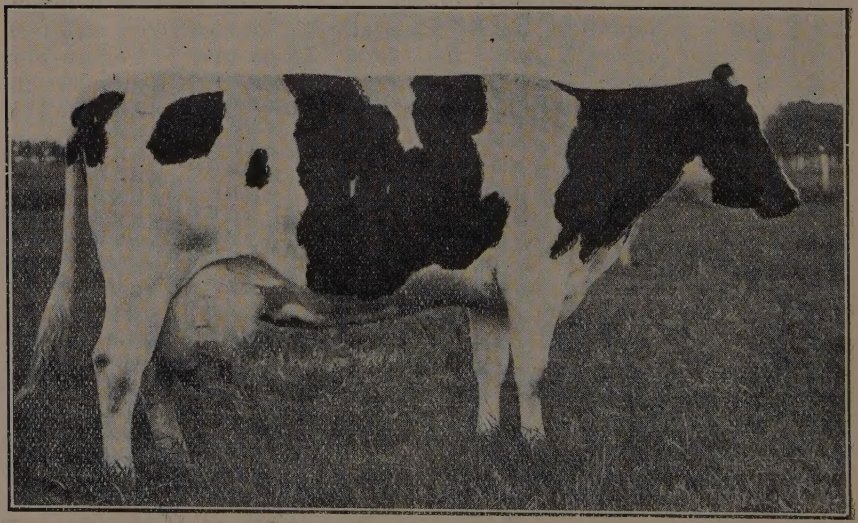

FIG. 2. TOTARA SYLVIA COLANTHA (PIRI LAND CO., AUCKLAND).
C.O.R. in Friesian mature class: 26,310·1 lb. milk, 1,024·37 lb. butterfat.

FIG. 3. TOTARA C. R. BUTTERCUP (PIRI LAND CO., AUCKLAND).
Leader of the Friesian senior three-year-old class: 25,885·3 lb. milk, 989·10 lb. butterfat.

The list of Friesian class-leaders is now as follows:—

Table 6.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys	lb.		lb.	lb.
Junior Two-year-old. Monavale Queen Bess	T. H. Richards, Cardiff	2 16	242·1	365	20,501 1	740·50
Senior Two-year-old. Pareora Echo Blossom	T. Sheriff, Clandeboye	2 223	262·8	365	22,671·9	819·81
Junior Three-year-old. Monavale Queen Bess	T. H. Richards, Cardiff	3 56	282·6	365	21,609·3	800·18
Senior Three-year-old Totara C. R. Buttercup	Piri Land Co., Auckland	3 247	336·7	365	25,885·3	989·10
Junior Four-year-old. Westmere Princess Pietertje	John Donald, Westmere	4 156	329·1	365	24,199·0	939·78
Senior Four-year-old. Bainfield 27th ..	C. H. Potter, Pukerau	4 351	348·6	365	23,203·3	910·74
Mature. Alcartra Clothilde Pietje	Vernon Marx, Mangatoki	7 355	350·0	365	31,312·5	1,145·24

Friesian Class Averages.

In 1931 some ninety-five certificates in the yearly division were issued to Friesian cows, as compared with ninety-six certificates in 1930. The breed as a whole had an average production for the year of 559·01 lb. butterfat, an increase of no less than 30 lb. over the 1930 figure of 528·04 lb. All the class averages reached a very high standard, but annual comparisons are of little value on account of the small number of animals in some of the classes and the consequent disproportionate influence of individual performances. The class averages for 1931 and 1930 are as follows :—

Table 7.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1931.		lb.	lb.
Junior two-year-old ..	33	346	13,997·1	500·25
Senior two-year-old ..	6	347	14,025·4	500·51
Junior three-year-old ..	7	349	15,069·2	528·10
Senior three-year-old ..	11	337	14,441·5	529·48
Junior four-year-old ..	8	345	16,719·5	608·30
Senior four-year-old ..	6	360	16,629·6	599·53
Mature	24	352	18,115·6	650·40
	1930.			
Junior two-year-old ..	36	340	12,377·3	443·26
Senior two-year-old ..	13	356	15,061·6	539·11
Junior three-year-old ..	10	354	14,382·2	500·17
Senior three-year-old ..	4	349	16,714·4	577·10
Junior four-year-old ..	3	333	11,264·1	411·65
Senior four-year-old ..	9	352	17,834·2	620·68
Mature	21	350	16,586·2	614·48

The averages, class by class, of all certificates issued to Friesian cows since the commencement of the C.O.R. system are given in the following table :—

Table 8.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	569	344	11,692·0	414·41
Senior two-year-old ..	247	347	12,585·1	446·75
Junior three-year-old ..	179	342	13,365·7	469·15
Senior three-year-old ..	179	336	13,842·7	495·43
Junior four-year-old ..	116	344	14,966·5	528·80
Senior four-year-old ..	120	346	15,866·2	553·19
Mature	524	341	15,868·5	556·43
All	1,934	343	13,747·0	485·06
Average Test, 3·52.				

Friesian C.O.R. Bulls.

The Friesian C.O.R. bulls now total 107, four new bulls having qualified during the year. The number of sires represented in the 1,569 Friesian cows certificated to the end of 1931 is 556.

MILKING SHORTHORNS.

Class-leaders.

The past year was uneventful so far as the Milking Shorthorn breed is concerned, there being no records of outstanding merit, nor any which seriously challenged the existing class-leaderships. The list remains as follows:—

Table 9.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs.dys.	lb.		lb.	lb.
Junior Two-year-old.						
Matangi Quality 4th	Ranstead Bros., Matangi	2 109	251·4	365	14,572·8	591·89
Senior Two-year-old.						
Matangi Quality 5th	Ranstead Bros., Matangi	2 204	260·9	365	11,752·8	542·66
Junior Three-year-old.						
Matangi Quality 4th	Ranstead Bros., Matangi	3 153	292·3	365	16,281·4	678·02
Senior Three-year-old.						
Matangi Ruth 2nd..	Ranstead Bros., Matangi	3 304	307·4	365	14,032·7	747·86
Junior Four-year-old.						
Matangi Matilda 4th	Hon. Mrs. E. J. Blyth, Kohimarama	4 0	313·5	358	14,640·2	630·38
Senior Four-year-old.						
Matangi Ruth 2nd..	Ranstead Bros., Matangi	4 355	349·0	340	11,670·3	644·90
Mature.						
Glenthorpe Lady ..	A. J. Melville, Buckland	Mature	350·0	365	20,136·2	856·85

Milking Shorthorn Class Averages.

Eighteen Milking Shorthorns, with an average production of 446·13 lb. butterfat, were tested in 1931, compared with twenty-three with an average of 449·44 lb. for the preceding year. Only five out of the seven classes recognized by this breed were represented, there being no certificates gained in the junior two- or junior four-year-old class. There were four senior two-year-olds averaging 370·53 lb. butterfat, two junior three-year-olds averaging 422·89 lb., three senior three-year-olds averaging 394·99 lb., three senior four-year-olds averaging 400·23 lb., and six mature cows averaging 552·79 lb. With so small a number the presentation of a table of class averages is scarcely justified.

The averages, class by class, of all certificates issued to Milking Shorthorn cows since the commencement of C.O.R. testing for this breed in 1914 are shown in Table 10, which follows.

Table 10.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old* ..	53	348	8,374·6	343·79
Senior two-year-old ..	34	347	8,813·9	359·55
Junior three-year-old ..	24	334	9,689·3	387·13
Senior three year-old ..	27	341	10,621·9	442·34
Junior four-year-old* ..	21	347	11,081·6	444·99
Senior four-year-old ..	30	342	11,440·3	452·00
Mature	260	341	11,746·6	471·29
All	449	342	10,897·3	439·02
Average test, 4·02.				

* No additions in 1931.

Milking Shorthorn C.O.R. Bulls.

The number of C.O.R. bulls of this breed remains at twelve, no new names having been added during the year. The 408 cows certificated to the end of 1931 were sired by 128 different bulls.

AYRSHIRES.

Class-leaders.

No new Ayrshire class-leaders appeared during the year under review, neither were any outstanding performances recorded. The list is repeated as follows:—

Table 11.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butterfat.
		Yrs. dys.	lb.		lb.	lb.
Two-year-old.						
Fair Maid of Greenbank	W. Moore, Homebush	2 27	243·2	365	12,281·3	673·56
Three-year-old.						
Maesgwyn Victoria ..	C. Morgan Williams, Kaiapoi	3 250	302·0	365	16,507·7	646·98
Four-year-old.						
Ivanhoe Fancy ..	A. M. Weir, Menzies Ferry	4 308	344·3	365	14,207·7	713·93
Mature.						
Floss of Braeside ..	W. Moore, Homebush	7 287	350·0	365	20,305·5	832·72

Ayrshire Class Averages.

Eleven first-class certificates were issued to Ayrshire cows in 1931, as against fourteen in 1930, the average butterfat production figures being 428·84 lb. and 458·40 lb. respectively. Classifying according to age the eleven certificates issued last year, it is found that there were

three cows in the two-year-old class, with an average of 409·95 lb. butterfat; two three-year-olds averaging 429·96 lb.; one four-year-old with 427·89 lb.; and five mature cows averaging 439·91 lb.

The averages, class by class, for all certificates issued to Ayrshire cows since the commencement of C.O.R. testing in 1912 are supplied by the following table:—

Table 12.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Two-year-old	59	344	8,862·9	368·41
Three-year-old	38	347	10,043·0	414·16
Four-year-old	26	346	11,218·0	453·62
Mature	108	349	11,914·5	484·76
All	231	347	10,748·8	439·92
Average test, 4·09.				

Ayrshire C.O.R. Bulls.

Two new names were added to the Ayrshire C.O.R. bull list during the year, the total now being nine. The 205 Ayrshire cows with first-class certificates-of-record were the daughters of 118 sires.

Red Polls.

Three Red Poll cows gained certificates in 1931, one of these, Waihou Pip, owned by Mr. W. Jackson, of Waihou, winning the leadership of the mature class from Mr. G. S. Young's Wayward 6th B. No. 1, with 537·90 lb. butterfat, a narrow margin of 1·40 lb. Mr. Jackson's Waihou Best Girl, a three-year-old, produced 445·16 lb., a creditable performance. The third Red Poll cow under test last year was Winsome 12th, in the mature class, owned by Sir Heaton Rhodes, of Tai Tapu; her production of 534·54 lb. in 351 days came very near that of both the new and the old leader of the class.

The Red Poll class-leaders are now as follows:—

Table 13.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days	Milk.	Butterfat.
		Yrs. dys.	lb.		lb.	lb.
Two-year-old.						
Wayward 6th B No. 1	G. S. Young, West Plains	2 188	259·3	365	11,228·0	511·42
Three-year-old.						
Dominion Gold Top..	Central Development Farm, Weraroa	3 302	307·2	365	9,491·25	459·46
Four-year-old.						
Wayward 6th B No. 1	G. S. Young, West Plains	4 297	343·2	365	13,290·0	580·05
Mature.						
Waihou Pip	W. Jackson, Waihou	7 25	385·0	365	12,681·8	537·90

The averages, class by class, for all certificates issued to Red Poll cows since the commencement of C.O.R. testing for this breed in 1918 are as follows:—

Table 14.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Two-year-old*	37	343	7,580·1	337·61
Three-year-old	14	348	8,004·4	350·45
Four-year-old*	6	343	9,909·1	425·86
Mature	22	337	10,483·5	441·28
All	79	342	8,640·77	375·46
Average test, 4·34.				

*No additions in 1931.

Red Poll C.O.R. Bulls.

The Red Poll C.O.R. bull list remains unaltered, and numbers three. Altogether twenty-five sires are represented by the sixty Red Poll cows so far certificated.

(2) C.O.R. 305-day Test Division.

Briefly expressed, the C.O.R. 305-day test varies from the C.O.R. yearly test in three main points—namely, maximum duration of test, period between calvings, and minimum butterfat requirement. The maximum testing period is 305 days, as against 365; the period between calvings for first-class certificate is 395 days, as compared with 455 days; while the butterfat standard increases from 250·5 lb. for a two-year-old to 360 lb. for a mature cow, as against 275·5 lb. to 385·0 lb. in the yearly test. As will be seen, the standard in the 305-day class is 25 lb. of butterfat less than in the full-year division.

First-class Certificates issued.

Only three breeds gained certificates under this branch of the C.O.R. test, no 305-day entries having been received from the Ayrshires or Red Polls. Particulars of number of certificates issued are as follows: Jerseys, 97; Friesian, 9; Milking Shorthorn, 1: a total of 107.

Second-class Certificates.

One second-class 305-day certificate was issued during the year, this being a three-year-old Jersey, which failed by some ten days to calve subsequent to test within the 395 days stipulated by the rules.

Jerseys.

Class Averages.

In Table 15 are given the averages, class by class, of the ninety-seven certificates issued during 1931 to Jersey cows in the 305-day division test. The average for all cows was 421·12 lb. butterfat, the average test being 5·58 per cent.

Table 15.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1931.		lb.	lb.
Junior two-year-old ..	39	302	6,553·6	373·49
Senior two-year-old ..	5	304	8,163·5	460·23
Three-year-old	13	296	7,556·2	424·09
Four-year-old	15	302	8,216·6	458·40
Mature	25	302	8,527·0	463·69

Jersey Class-leaders.

The first year's Jersey class-leaders under the 305-day test are given in Table 16. Considering the length of lactation and the small number of entries some of the yields, particularly those in the younger classes, must be considered as decidedly creditable.

Table 16.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Fat.
Junior Two-year-old.		Yrs.dys.	lb.		lb.	lb.
Beloved	R. S. Tuck, Waharoa	1 328	250·5	305	9,337·5	500·36
Senior Two-year-old.						
Erinview Choice ..	J. Murray, Woodville	2 344	284·9	305	9,798·7	559·42
Three-year-old.						
Brentwood Emerald	C. A. Willis, Pukekohe	3 357	322·7	305	10,585·9	608·13
Four-year-old.						
Brentwood Lady Winnie	C. A. Willis, Pukekohe	4 11	324·6	305	10,297·3	535·47
Mature.						
Woodlands Veta ..	H. C. Sampson, Hillsborough	7 351	360·0	305	9,463·0	578·34

FRIESIANS.

Class Averages.

There having been only nine Friesian certificates issued in the 305-day class, a class-average table is obviously of little value. The nine certificates averaged 423·64 lb. butterfat, with an average test of 3·57 per cent.

Class-leaders.

Table 17 gives the highest Friesian yields for each class represented in the 305-day division during the year. Entries were received for only five of the seven classes into which this breed is usually subdivided.

Table 17.

Name of Cows and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Waterloo Queen Helen Beets	R. S. Tuck, jun., Waharoa	2 4	250·9	305	11,585·5	425·48
Senior Two-year-old.						
Rosevale Beauty Posch Griselda	E. H. Watson, Windsor	2 216	272·1	305	12,273·5	468·50
Junior Three-year-old	..	..	..	..	..	..
Senior Three-year-old.						
Sealands Alcartra Fobes	H. G. A. Cameron, Weraroa	3 304	317·4	305	10,407·8	389·04
Junior Four-year-old	..	..	..	..	..	..
Senior Four-year-old.						
Ellerlea Aaggie Segis Minto	C. H. Steadman, Pokapu	4 357	359·2	305	15,311·9	557·71
Mature.						
Ellerlea Countess Minto De Kol	C. H. Steadman, Pokapu	8 139	360·0	305	12,761·3	454·11

Milking Shorthorns.

One cow of the Milking Shorthorn breed gained a certificate in the 305-day class. This cow, Pinedale Rona, owned by Mr. G. D. Hall, Kiokio, Otorohanga, commenced test at the age of 3 years 35 days, and is credited with a production of 8,862·4 lb. milk, containing 416·51 lb. butterfat, in 305 days.

The thanks of the Dairy Division are once more due for the assistance and friendly co-operation of the secretaries of the various breeders' associations whose breeds take part in certificate-of-record testing.

Summer Application of Winter Oils in Orchard Practice.—Many growers in the Mapua district (Nelson) have experienced much difficulty in obtaining perfect emulsions of the winter oils for summer application, following lime-sulphur. The cause appears to be mainly due to the absorption of sulphur compounds by the wooden vats, and the trouble cannot be overcome by washing with water no matter how thoroughly the operation is performed. Even growers of long experience have sustained damage from the use of oils where a reasonable quantity of the emulsified oil is not run through the pipes to remove all traces of the lime-sulphur previously used. The trouble has been quite successfully overcome by mixing a small quantity of primary emulsion in a tin vessel, and employing the emulsion to bathe the sides of the vat. Apparently the effect is that it seals the pores of the wood and acts as an interception agent between the oil and the sulphur. The use of soap-powder is also very helpful if used in the water for making primary emulsion at the rate of 2 oz. to 4 gallons of water, this being much preferable to soda.—*M. Davey, Orchard Instructor, Mapua.*

IRON LICKS FOR BUSH SICKNESS.

FURTHER EXPERIENCES WITH SHEEP AND CATTLE.

B. C. ASTON, Chief Chemist, Department of Agriculture.

Now that the correct treatment of the group of deficiency diseases known as "bush sickness" in New Zealand, "coast disease" in Tasmania, "nakuruitis" in Kenya, "salt sick" in Florida, and "pining" in Scotland, is recognized to be the administration of iron, preferably to the animal automatically as a salt lick, the practical treatment of bush sickness in the field is narrowed down to the selection of the most efficacious form of iron obtainable.

Since 1914 various sources of iron obtainable in this Dominion have been the subject of experiment at the Mamaku Demonstration Farm, where a paddock was dressed with limonite as early as November, 1914. Being restricted to sources which were accessible as well as suitable, the following were the forms of iron experimented with in chronological order: (1) Limonite from Whangarei, 1914; (2) gasworks spent oxide of iron made from the Whangarei material, 1915; (3) limonite from Onekaka, Nelson, December, 1924; (4) spathic iron ore, Huntly, 1926.

Of these when applied as a dressing for pasture the only one which gave any success was the spent oxide from the Auckland or Hamilton gasworks, which was applied at the rate of 10 cwt. per acre. This experiment was notable as showing the efficacy of spent oxide in keeping grown sheep healthy for a much longer time on affected country than otherwise would be possible (see this Department's annual report for the year 1916–17, p. 13).

Spent iron oxide from gasworks is obtainable at a nominal cost. Apart from its soluble iron content it contains nitrogenous compounds which are useful as a pasture top-dressing. In excess, however, it is used as a weed poison for paths and roads, and owing to the contained poisonous properties it cannot be used as a stock-lick.

Of the three other iron compounds available, the Onekaka hydrated oxide (limonite)—of which some tons were specially ground for Mamaku in December, 1924, and subsequently—was tried as a sheep-lick, but found to be too coarsely ground, the sheep refusing to take it when mixed with salt.

The impure carbonate of iron from the Huntly clay-pit, first obtained in 1926, was experimented with at considerable length after finely grinding the raw material (a costly matter) in a phosphate mill. This gave satisfactory results with cattle as a lick, with calves mixed in their feed-milk, and also as a lick, and with sheep when fed as pellets. (See this *Journal* for January, 1929, p. 14; April, 1929, p. 233; March, 1930, p. 188; June, 1931, p. 369; July, 1931, p. 11.) The quality of this material, however, is variable. In some ground samples it has been found by chemical analysis to vary so much as 10 per cent. in the siliceous matter. The Whangarei limonite is now proving superior in treating sheep.

An error crept into a recent report in which it was stated that Scotch bog iron (impure limonite) was used in Kenya. This now turns

out to be a mistake, the material there used being hæmatite, so that the New Zealand Department is entitled to the credit of being the first to use the limonite as a lick for supplying food-iron to stock.

The Whangarei material is the softest of the three crude iron ores mentioned. It is already marketed in considerable quantities by the owners of the two deposits at Whangarei for the purpose of purifying coal-gas, some 500 tons a year being handled. With very little extra trouble the material is being screened or otherwise reduced to a powder finer than that used in gasworks, and the deposits are close to rail and harbour for transport to every iron-hungry animal in the North Island.

Farmers' Experiences in Treatment.

A number of further replies from farmers in the bush-sick districts have come in giving the results of their experience in using spathic iron ore as a lick. A Tauranga farmer, under date 2nd January, 1932, writes:—

> We first tried it mixed with 33⅓ per cent. of salt, which the cows did not take to kindly. We then increased the quantity of salt to a 50–50 basis, reserving a little salt for the top of containers which we moistened. This formed a crust and the cattle took to it readily. So far not one of the 130 dairy cows have shown any sign of sickness. They are in splendid condition and their coats shine like silk, which undoubtedly proves the mixture is very beneficial to them. The calves have had small quantities mixed with their milk, and they have thrived exceptionally well.

An Omanawa farmer writes under date 11th January, 1932:—

> In reporting on the results of using the carbonate of iron I may say that I have given it to the milking-cows in the bails, and in the paddock for the young stock, also as a lick for the calves. I have not had a sick beast on the farm since I commenced to use the lick.

A Tokoroa farmer, under date 14th December, 1931, writes:—

> I found the cattle took to the mixture as advised by the Department readily and without any trouble. I have not used any other lick for four years, and have had less trouble *re* sickness during this period than during my seven years here. My cows this year are looking splendid, my two- and three-year-old heifers are a picture. I still have the same bull that I bred here six years ago.

A Poverty Bay back-country farmer writes under date 17th December, 1931:—

> My ram hoggets did wonderfully well after I started feeding iron and salt and bonedust as per your instructions, and although sheep throughout the district have done exceptionally well this season the change was so prompt and outstanding that I give credit to the lick.

A Te Puke farmer, under date 28th December, 1931, writes:—

> I find the iron readily taken by stock when mixed with equal parts of steamed bone-flour and iodized salt. I have found no difficulty in keeping animals in health by using the mixture. To prove this I put a portion of my dairy herd on swamp country last winter and kept a portion back. They received nothing but rough feed and the lick. Those that were on the swamp came in weak and thin, while those that were kept behind came in in fine fettle, showing neither weakness nor any debility. The feed on the swamp was mixed pasture but not top-dressed. I find that the cows that remained at home and had access to the lick are milking considerably better than the others grazed on the swamp, and came right to their milk after calving, while the remainder are only getting into their stride now. I find the iron most beneficial when used with the other two ingredients. I gave the iron mixed with meat-meal to my calves in their daily milk ration at the rate of ½ oz. of iron to 3 oz. of meat-meal in one gallon of separated milk, from the fourteenth day till the end of the third month, and

they have never looked behind them. I have the finest calves this year I have ever reared. They have constant access to the lick and plenty of water.

A Pikowai farmer, under date 3rd January, 1932, writes :—

I have mixed the carbonate of iron and salt and find my dairy cows like it. Of course, some take much more than others and some none at all. I suppose those do not require it. I have generally given my calves iron citrate in their skim milk, but this year have given them the carbonate instead plus a little meat-meal, and the calves have done remarkably well.

A Rotorua farmer gives, under date 10th January, 1932, his experience with the half-and-half iron oxide and salt mixture as follows :—

Two calves went sick after weaning. One improved after I placed the lick in a handy position; the other would not take the lick, so I gave it about a teaspoonful in the mouth dry daily, and there was a very definite improvement in about a week. It appears to be now quite normal. The rest of the calves are taking the lick and are quite normal, though they received very little citrate in the milk. I think the placing of the lick in a handy position is all that is required for rearing calves, and any not taking it should be treated as above. The advantage of training calves to take the lick when young is quite apparent, at least in most cases, and in regard to this I think that it is very important to get stock on to the lick while in robust condition, as the more vigorous stock appear to take the lick most readily.

The Atiamuri Experiment with Sheep: Success of Hydrated Oxide of Iron (Limonite).

Early in May, 1931, an experiment with sheep was inaugurated at Atiamuri to determine whether lambs could be successfully reared on this country with the aid of a lick supplying food-iron. The land is a poor volcanic type, originally in scrub (manoao and manuka). The pasture on the hills is much better than on the flats, the soil of which is often of a coarse pumiceous nature, technically a sandy silt, whereas the soil on the hills is finer in texture with a retentive subsoil below 18 in. The pasture is of a better quality than that of the unmanured land found in the vicinity, cocksfoot, timothy, rye-grass, Poa pratensis, and clovers being present, the practice of top-dressing annually with 2 cwt. of superphosphate per acre having been followed for some years.

Last autumn the usual dressing was changed for one consisting of equal parts of superphosphate and basic slag at the rate of 2 cwt. per acre of the mixture. No difference was made in the grazing of any group of sheep, the whole flock having practically the same treatment, with the exception of those receiving lick treatment. From a flock of two thousand ewes four groups of fifty each were selected, the age of the animals being between two and three years, all of which had been on the property for not less than two years. The groups were treated as follows :—

No. 1 : Control, no lick.
No. 2 : Lick containing iron ammonium citrate and salt.
No. 3 : Lick containing hydrated iron oxide (Whangarei) and salt.
No. 4 : Lick containing spathic iron ore and salt.

All groups grazed the same sets of paddocks in rotation, thus eliminating any possible advantage derived from difference in grazing. No difficulty was experienced in getting the ewes to take the iron oxide lick, but difficulty was experienced in getting them to take the iron ammonium citrate lick, which was only sparingly consumed.

The spathic iron or carbonate of iron lick for some reason was not successful, and treatment was discontinued. A possible explanation for this, suggested by Mr. C. R. Taylor, is that insufficient care was exercised in selecting the boulders for grinding, so that the material may have contained very little iron carbonate, a contention that chemical analyses support.

In each group of fifty ewes twelve were selected for weighing at monthly periods throughout the duration of the experiment.

FIG. 1. GROUP OF LIMONITE-TREATED EWES AND LAMBS.

Note good condition generally, and size of the lambs. Photo taken 14th January, 1932.

FIG. 2. GROUP OF CONTROL EWES (UNTREATED).

Most of the lambs of this group were dead when photo taken on 14th January.

At a farmers' field-day held on 20th February, a large number of farmers attending from Tokoroa, Waotu, Puketurua, and Putaruru, the following position was disclosed by Mr. C. R. Taylor, in charge of the experiment, and Mr. D. Marshall, Government Veterinarian stationed at Hamilton: All the lambs of the control group of ewes and the iron ammonium citrate group of ewes were dead. Of the

iron oxide group, forty-four lambs from forty-five ewes were an outstanding feature of the experiment, the ewes being particularly bright and healthy, while the lambs were well built, robust, with a healthy bloom on the wool, and gave the impression that they had come off good sheep-country. The total cost of this treatment, including oxide of iron and salt for the nine-months period was slightly over 5½d. per head. The control group, sixteen surviving ewes, were poor in condition and unthrifty. The iron and ammonium citrate group, twenty-four surviving ewes, showed an improvement over the control group, but were still much below the standard set by the iron oxide group. The cost of the treatment by citrate was slightly above 3d. per head. A post-mortem examination was made of two lambs. One from the oxide group, which killed out at 44½ lb., was in a perfectly healthy condition and entirely free from parasites. A lamb from the untreated mob, in rather poor condition, was killed and showed every sign of parasitic infestation, being "full of worms."

This experiment should establish the fact that healthy sheep can be reared from the Atiamuri type of country if this latest treatment is adopted. The cost of 5½d. per head will still leave the farmer with a satisfactory margin of profit. A fair inference from the post-mortem examination of the two lambs would be that the iron oxide treatment of the mother ewes had not only enabled their lambs to develop normally, but also to resist parasitic invasion. Treatment of the mother ewe is the secret of success, according to Mr. Taylor. Endeavour to treat the lambs has proved useless.

Thanks are due to Mr. T. V. Humphrey, manager of the property on which this experiment was carried out, and to Mr. E. A. Woodcock, one of his assistants, for making possible these lengthy trials with sheep, necessitating much careful attention on their part, which they have keenly given at all times.

The results of the experiment may be summarized as follows:—

Average Live Weight of Ewes at Commencement of Experiment (5th May, 1931, and again after Nine Months' Treatment (8th February, 1932).

—	5th May, 1931.	8th February, 1932.
	lb.	lb.
Limonite or oxide group ..	120	128
Iron ammonium citrate group ..	112	92
Control group (no treatment) ..	114	72

Lambing Percentages.

	At Birth.	When marked.
Limonite group	100	90
Iron ammonium citrate group ..	62	16
Control group	76	50

All the lambs of both the citrate and control groups were dead by the end of January, 1932. Only five of the limonite group have been lost, and these deaths were chiefly due to causes other than bush sickness. In one case only was there a suspicion of doubt, and in this instance death has been recorded as due to bush sickness.

The numerical strength of each of the respective groups under trial at the commencement of experiment (5th May, 1931) was fifty ewes, all of which had been on the property for not less than two years. Their ages varied between two and three years. The numerical strength and average weight of fleece of the same groups at time of writing (20th February) are as follows:—

	Number.	Weight of Fleece.
Limonite group	.. 45	8½ lb.
Iron ammonium citrate group	.. 24	About 7 lb.
Control group	.. 16	6½ lb.

The cost of treatment per head of the two treated groups for nine months is as follows: Limonite group—2·8d. for limonite, and a similar amount for coarse salt; total, 5·6d. Iron ammonium citrate group—1·008d. for iron ammonium citrate, and 2·060d. for coarse salt; total, 3·068d.

It was found that owing to the flavour of the iron ammonium citrate the sheep would not voluntarily take it, when incorporated in a salt lick, in anything like the quantity necessary to keep them in health; hence the results obtained. With the limonite, which has no objectionable flavour whatsoever, no trouble was experienced from start to finish of the experiments, the sheep at all times taking it readily when and as required. For this reason it is to be recommended as an efficacious and practical treatment for cattle and sheep in those districts where past experience has demonstrated that drenching, &c., with iron ammonium citrate has given the desired results.

It is important to note that all groups have grazed the same set of paddocks in rotation, thus eliminating any possible suggestion that any particular group has been favoured in treatment (other than licks). For a number of years past 2 cwt. of superphosphate has been the only top-dressing used; last spring 2 cwt. of super and slag mixture (half-and-half) was applied instead. No liming has been done at any time.

The average live weight of the limonite-treated lambs works out at 78 lb., and the carcass weight at approximately 39 lb. on the hooks, which can only be regarded as a very fine performance viewed in the light of past experience on this property.

The lambs of all the other groups are now dead, so that comparable figures cannot be given for this period. The results, however, provide ample evidence of the efficacy of limonite as a means of keeping sheep, and later lambs, in a healthy condition on pumice country—hitherto found impossible.

Conversion of Paspalum Grassland. — The Instructor in Agriculture at Whangarei, North Auckland, reports as follows: "On several farms pastures have recently been brought to my notice where, by top-dressing regularly with phosphates, and improved grazing and harrowing, what were originally more or less root-bound paspalum fields have been converted to excellent perennial rye-grass, white clover, and paspalum pasture. The perennial rye is exceptionally strong in the early spring, and the question has been raised as to whether the paspalum will be able to hold its own. The quantity of feed produced in the summer is said to be less than in past seasons, and it would appear possible for the strong growth of perennial rye to thin out the paspalum to such an extent that its production would fall off."

ORCHARD SPRAYS IN NEW ZEALAND.

I. THE SULPHUR SERIES.

G. H. CUNNINGHAM, Mycologist, Plant Research Station, Palmerston North.

THIS is the first of a series of articles covering the orchard sprays in commercial use in New Zealand. The articles are based on information secured as the result of recent investigations conducted primarily to obtain data for framing the regulations necessary to make operative the Fungicides and Insecticides Act of 1927. The object of the present paper is to discuss the available types of sulphur, to indicate their respective values, the unit by which such values may be assessed, the manner in which sulphur acts as a fungicide, &c.

HOW SULPHUR ACTS AS A FUNGICIDE.

Although sulphur has been used as a fungicide since 1846 (in which year it was introduced in England to combat the mildew of grape-vines), it has only comparatively recently been introduced into orchard practice. In New Zealand it was first used about 1916 to combat powdery-mildew and black-spot of apple-trees, and more recently, alone or in the form of the so-called "dry mix," as a controllant of brown-rot and leaf-rust of stone fruits. Although this material has been in use for a longer period than any other spray, it must be admitted that even to-day the manner in which it acts is but imperfectly understood. Numerous theories have been published, and the fungicidal action of sulphur has been attributed to many compounds which it is capable of forming when combined with oxygen or hydrogen. Thus, writers have held that its toxicity was due to the production of gases such as sulphur dioxide or hydrogen sulphide; to the production of sulphurous, sulphuric, thio-sulphuric, or pentathionic acids; or due to the fact that it acted directly either in the form of finely divided particles or as sulphur vapour.

From a consideration of the experimental data presented it is probable that the following approximates to an accurate explanation of the toxicity of this element. It would appear that when sulphur is applied to a plant it gives off continuously either minute solid particles (Barker, 1928), or, what is more probable, a volatile gaseous sulphur (Goodwin and Martin, 1928; McCallan and Wilcoxon, 1931). This vapour (or these particles) is diffused through the air and deposited upon spores or hyphæ of fungi in the vicinity, as well as upon host-plant tissues, and there condensed to solid particles of sulphur. According to Goodwin and Martin (1929) it is these minute particles which are toxic to fungi to which they have been applied; but Barker (1928, 1930) and McCallan and Wilcoxon (1931) consider that these particles are converted into hydrogen sulphide, which acts as the toxic agent. Barker (1930) thought that conversion of these minute particles into hydrogen sulphide was effected upon the exterior of the fungus (or host plant) by means of a substance emerging from the tissues; whereas McCallan and

Wilcoxon (1931) held that conversion occurred within the tissues. In both reduction was considered to be of an enzymic nature. It has been convincingly shown by the experiments of Marsh (1928), Barker (1928, 1930), and McCallan and Wilcoxon (1931) that the gas hydrogen sulphide is toxic to fungi (and, in lesser degree, to the host-plant tissues) as was demonstrated first apparently by Pollacci (1875) upwards of half a century ago.

Factors affecting the Fungicidal Efficiency of Sulphur.

Recent investigations have shown that the fungicidal value of a sulphur may be measured by the size of the particles of which it is composed. Thus Young (1922), Wilcoxon and McCallan (1930), and Goodwin, Martin, and Salmon (1930) have shown that the toxicity of a sulphur is increased as the size of the sulphur particles is decreased. This may be due to the fact that the smaller the particles the greater the surface area, with a consequent increase in the quantities of sulphur vapour produced by a given amount of sulphur. There is also a definite correlation between the size of the sulphur particles and the quantity which remains upon fruit and foliage after application. For Fitch (1925) found that from 40 to 64 per cent. of a dusting sulphur was lost shortly after application; and Thatcher and Streeter (1925) showed that when a sublimed sulphur was applied from 89 to 94 per cent. was lost within one week of application. In this Laboratory it has been found that whereas the majority of the particles of a sublimed sulphur had disappeared from leaves sprayed four days previously (save those caught in leaf-hairs or lodged in crevices), leaves sprayed with a colloidal sulphur were found to be coated with a continuous film of particles, which were not dislodged when leaves were sectioned for examination. From an examination of leaves sprayed with different sulphurs it is evident that particles of a size in excess of 50 microns (this term will be explained below) fail to adhere to foliage for more than four days, the majority disappearing within a few hours of application.

The practical significance of this is that the smaller the particles the greater the amount of sulphur which will remain on a tree for a given time, permitting of a reduction in the quantities of the finer sulphurs that need be applied.

Efficacy of a sulphur may be affected by the degree of coverage secured; thus it is possible that the greater efficacy of a colloidal sulphur over a sublimed or ground sulphur is due to the fact that with the former a continuous film of particles is deposited over the leaf or fruit surfaces, whereas with the latter the particles, at normal dosages, are somewhat widely scattered.

The size of the particles likewise plays a part in the practical application of sulphur sprays. Mixed with water only the finest of sulphurs will remain in suspension for more than a brief period, the others requiring constant agitation to prevent the particles settling in the spray-tank. This is significant, as where stationary power plants are in operation there is danger of blockage of pipe-lines, where these are at all long, when coarse sulphurs are used.

Measurement of Sulphur Particles.

As has been shown, the value of a sulphur as a spray may be measured in terms of the size of the particles of which it is composed. For this purpose the following four methods have been used:—

(1) *Sieving.*—In the United States of America sulphurs are offered for sale on the basis of their being able to pass through certain sieves, 200- and 300-mesh sieves being regarded as standard for dusting and spraying purposes. Such sieves require that particles shall be of a theoretical size of not more than 74 microns for the 200 mesh, and about 47 microns for the 300 mesh. Actual measurements of samples of all commercial sulphurs on the New Zealand market have shown that the sizes of maximum particles range between 125 and 175 microns, quite 60 per cent. of the most finely ground being above 50 microns. It is evident therefore that there is little if any correlation between the sieve standards and the commercial materials offered on this market. Tests have shown that it is extremely difficult to pass even small quantities of a ground sulphur through a 200-mesh sieve, and practically impossible to use the finer series, which precludes the practical application of this method of measurement.

(2) *Chancel Test.*—In this a given quantity of sulphur (usually 5 grammes) is placed in a vessel, termed a Chancel tube, which is calibrated into one hundred divisions, each representing a "Chancel degree." To the tube is then added a given quantity of anhydrous ether. The mixture is then shaken and the sulphur allowed to settle, when its height in the tube is read in terms of degrees. The higher the reading the better the sulphur is supposed to be as a fungicide. Actual tests conducted in this Laboratory have shown that these Chancel degrees bear no relation to particle size, the best readings being secured with sulphurs in which the particles are aggregated into coarse groups. Consequently the process is worthless as a measure of the efficacy of sulphurs for spraying purposes.

(3) *Sedimentation Test.*—This is based on the assumption that particles of sulphur of different sizes have different periods of settlement.

The following method has been used in attempts to measure the relative fineness of colloidal sulphurs. Into glass cylinders are introduced, measured quantities of the sulphurs, and equal amounts of water added to each. The vessels are then agitated until complete suspension has been secured, and are then placed side by side, and the contents allowed to settle, the rate of settlement of each being measured at periodic intervals. Success is possible only if no protective colloid is present (substances, such as glue, added in small quantity to hold particles in suspension for a prolonged period), for the presence of such in any sample would prevent measured results from being secured, and moreover would be difficult to detect by analysis. It is noteworthy that protective colloids are usually used during the preparation of these sulphurs.

We have recently applied this test in modified form to measure the relative percentages of coarse and fine particles of ground and

sublimed sulphurs. In this process (which is still in the experimental stage) a given quantity of sulphur is mixed with a measured volume of water to which has been added a small quantity of soap solution to act as a wettable agent. After being agitated until all material is in suspension, each vessel is placed upright and the particles allowed to settle for a given time, when the water (containing the finer particles of sulphur) is pipetted off and placed in a second container. The process is repeated, varying degrees of fineness of particles being secured by varying the times of sedimentation. The precipitates are then dried and the sulphur content obtained by weighing. The method has so far proved reasonably reliable, since particles of these types of sulphur are usually too large to be affected appreciably by any colloid which may be present in the suspension. By applying the method to a commercial ground sulphur we have ascertained that between 60 and 70 per cent. of the particles are of a size in excess of 50 microns; and with a commercial sublimed sulphur between 85 and 90 per cent. were found to be in excess of this figure.

(4) *Microscopic Measurement.*—The use of the microscope in determining the relative sizes of particles of sulphur has not yet become general, since it is only recently that the significance of particle size has been demonstrated. But consideration of the available processes has shown that this is the only means at hand whereby the size of the particles of all types of sulphurs on the market may be gauged with any degree of accuracy, so that it is probable that this method will play an important part in future analyses. After making a study of all sulphurs offered for sale in New Zealand, I believe that by the aid of the microscope it is possible to segregate these sulphurs into groups upon certain characteristics described below.

The microscope shows that sublimed and ground sulphurs exhibit a great range in particle size. As it is not possible to average these, measurements must of necessity be given in minimum and maximum figures. Further subdivision of the sizes of the particles may be undertaken, if required, by the sedimentation test. As the unit of microscopy is the micron (which equals $\frac{1}{1000}$ of 1 millimetre, or about $\frac{1}{25000}$ of 1 in.) all measurements herein are expressed upon this scale.

Classification of Sulphurs.

Microscopic analysis of the commercial sulphurs available shows that it is possible to group them under the following four headings:—

(1) *Ground Sulphur.*—This sulphur, sometimes termed flour sulphur, is prepared by mechanical grinding of refined roll or lump sulphur. The characteristics of such a sulphur, as defined herein, are that the particles are in the form of crystals with definite cleavage angles, and are pale yellow and translucent in transmitted light. Whatever their size, they remain distinct from one another, and do not become massed into groups. The particles exhibit great diversity of size (Fig. 1), the minimum being as low as 4 microns, and the maximum in the vicinity of from 125 to 250 microns, according to the grade of the sample.

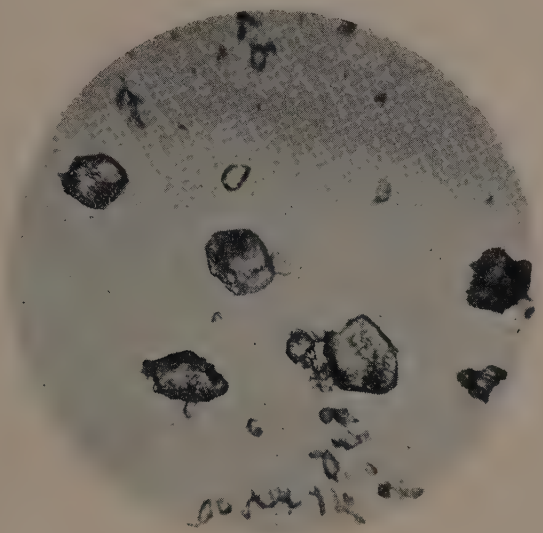

FIG. 1. PHOTOMICROGRAPH OF A GROUND SULPHUR. × 130.
Note crystalline nature of particles.

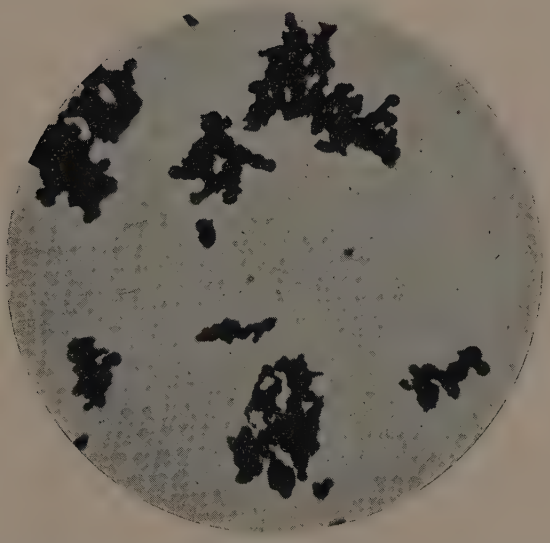

FIG. 2. PHOTOMICROGRAPH OF A SUBLIMED SULPHUR. × 130.
Note manner in which particles are agglutinated into masses.

[*Photomicrographs by W. D. Reid.*

Sulphurs of this type are usually applied at the rate of from 10 lb. to 12 lb. per 100 gallons of water.

(2) *Sublimed Sulphur.*—This material, commonly known as flowers of sulphur, is prepared by a process of sublimation. Sulphur or ore containing such is roasted in a furnace, and the vapour produced is led through flues into chambers where it is condensed by cooling and the sulphur deposited. Theoretically, such a sulphur is composed of rhomboid crystals, but in all commercial samples examined the particles were found to be more or less spheroidal, opaque, and firmly cemented into chains or irregular masses (Fig. 2). These aggregates vary greatly in size and shape, being from 150 to 400 microns across, and the particles of which they are composed when dissociated are between 8 and 30 microns. When such sulphurs are passed through a spray-pump, the masses do not break up to any appreciable extent, as has been demonstrated in this Laboratory by passing given quantities through a spray-pump (under a pressure of 100 lb.) on to sheets of paper, and examining these subsequently under the microscope. The fact that such a sulphur is largely composed of coarse particles, which precludes their remaining upon the leaf surface for any time, explains why sublimed sulphurs have proved relatively ineffective as controllants of black-spot and powdery-mildew in New Zealand.

Sublimed sulphurs are applied at rates comparable with ground sulphurs—namely, from 10 lb. to 12 lb. per 100 gallons.

(3) *Precipitated Sulphur.*—Under this heading are included certain sulphurs which occupy an intermediate position between the two just discussed and the colloidal series. Several have been offered for sale under the trade names of milk of sulphur, precipitated sulphur, or flotation sulphur. Their characteristics, as defined herein, are the size of the individual particles (2 to 12 microns), their crystalline translucent appearance, and the characteristic manner in which they tend to agglutinate into groups 200 microns or more across, which appear under the microscope not unlike snow or frost crystals (Fig. 3).

Sulphurs of this type are prepared by chemical precipitation, several methods being available, such as (*a*) by treating sodium thiosulphate with sodium bisulphate in the presence of glue; (*b*) by adding a saturated solution of sodium thiosulphate to concentrated sulphuric acid; or (*c*) by treating a solution of commercial lime-sulphur with sulphuric acid. Considerable confusion exists in literature as to the differences between these sulphurs and the colloidal series, as several prepared by chemical precipitation are called colloids. Materials prepared by the three processes mentioned are seen under the microscope to show the characteristic features of precipitants.

Precipitated sulphur has proved most disappointing when tested under field conditions, showing little if any improvement over ground or sublimed sulphurs. The probable reason for this is that the particles form aggregates which are too large to remain on the tree, since we have demonstrated that they are about 200 microns across and not broken up to any extent by passage through the spray-pump. This material is usually applied at between 6 lb. and 8 lb. per 100 gallons.

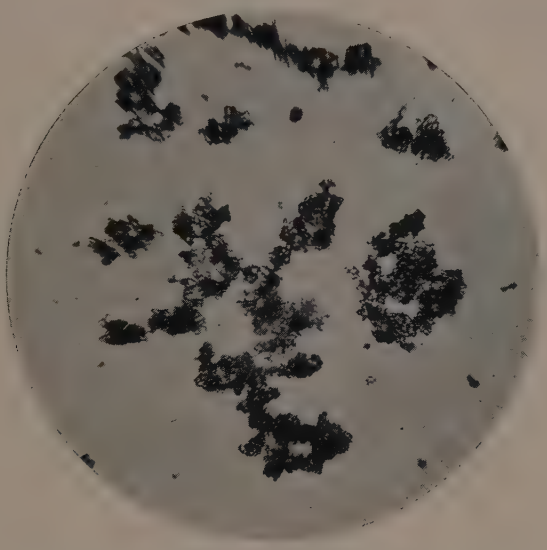

FIG. 3. PHOTOMICROGRAPH OF A PRECIPITATED SULPHUR. × 130.
Note crystalline particles agglutinated into masses.

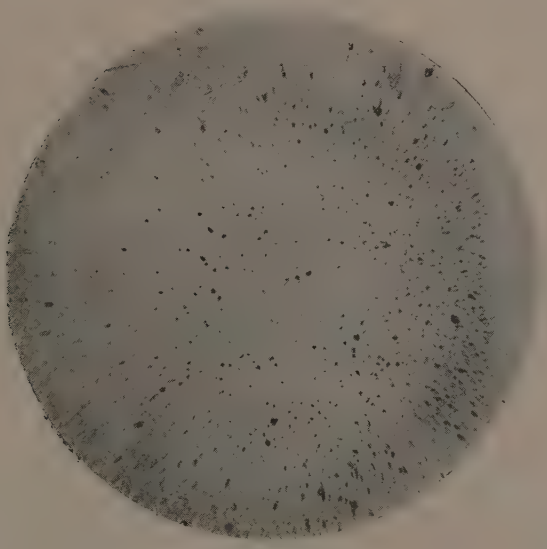

FIG. 4. PHOTOMICROGRAPH OF A COLLOIDAL SULPHUR. × 600.
Note the exceedingly fine particles and the manner in which they are dissociated. Only the larger particles are visible in this illustration.

[*Photomicrographs by W. D. Reid.*

(4) *Colloidal Sulphur.*—This name is applied to a group of sulphurs characterized in that the particles of which they are composed are mostly spheroidal in shape, of exceedingly fine dimensions, and do not aggregate, but remain dissociated (Fig. 4). The particles range in size from a small percentage of grains about 3 to 4 microns to ones so minute as to be beyond the limits of accurate measurement; the majority average between 0·5 and 1 micron.

This type of sulphur was introduced into the Dominion on a commercial scale only last season, but has been successfully used in Britain for the past three or four years, and is said to have largely displaced the coarser sulphurs in Europe. The name is rather unfortunate, since these materials are not colloids, but suspensions of minute particles of sulphur in water. The methods of preparation are trade secrets, and therefore not available; but it is probable they are prepared by electrical precipitation followed by grinding, in the presence of a protective colloid, in colloid mills of the Plauson type.

Colloidal sulphurs are recommended at from 2 lb. to 4 lb. per 100 gallons of water, on a basis of their containing 50 per cent. of sulphur in the concentrate.

The relative sizes of the particles of these four types of sulphurs may be summarized by the following table:—

Type of Sulphur.	Size of Particles.	
	Minimum.	Maximum.
	Microns.	Microns.
Ground*	4–8	125–250
Sublimed*	8–30	150–400
Precipitated	2–12	200
Colloidal	0·1†	4

* The maximum size of particles of these coarse sulphurs is governed by the grade of the sulphur under test, the figures given being secured from so-called 200- and 300-mesh samples.
† This figure is approximate, since it is not possible to measure accurately below about 0·25 micron.

Water Content.

Certain sulphurs are offered for sale in paste or fluid form. The advantage is that they can be mixed readily with water, but the disadvantage is that the sulphur content may vary in different brands, and thus upset the correct proportion of application. Consequently it is a matter of importance to the grower that he should know the water content of any brand, so that he may apply the recommended quantity of sulphur.

Wettable Agent.

As sulphur particles cannot be mixed readily with water it is customary to add to prepared spraying materials substances which will overcome this difficulty. Such treated sulphurs are known as wettable sulphurs. For this purpose any one of many substances (among which may be mentioned kaolin, calcium caseinate, glue, gelatine, soap, diatomaceous earth, hydrated lime, or alcoholic solutions of oleic acid) may be added to the sulphur in order to overcome the surface tension of the water sufficiently to enable a satisfactory suspension to be secured. As there is a possibility of reaction between

certain of these and other sprays with which the sulphur may be mixed, it is advisable to know the nature and percentage of the material used.

Uses of Sulphur Sprays.

In New Zealand sulphur sprays have been used since 1916 in the control of black-spot and powdery-mildew of apples, and since 1925 against brown-rot and leaf-rust of stone fruits. Until this last season only ground and sublimed sulphurs were used on a commercial scale, their use in recent years becoming general owing to a belief among orchardists that their addition to lime-sulphur tended to reduce the scorching and russetting effect of the latter on leaves and fruits. Precipitated sulphur was used to a lesser extent, since its high price and relative inefficiency compared it unfavourably with ground or sublimed sulphurs.

Experiments conducted in various parts of the Dominion during the past two seasons (particulars of which will be published at a later date) have shown that ground and sublimed sulphurs give partial control of black-spot, but have practically no effect upon powdery-mildew. Somewhat comparable results were secured with precipitated sulphur.

With colloidal sulphurs, on the other hand, outstanding results have been secured, for not only has this material (at 4–100) proved about equal to lime-sulphur as a controllant of black-spot, but it has given decidedly superior results in combating powdery-mildew. During the past season a commercial colloidal sulphur at the reduced strength of 2–100 gave almost complete control of powdery-mildew in one locality where lime-sulphur failed to hold it in check. The most outstanding results have been secured with a combination of colloidal sulphur and lime-sulphur (lime-sulphur 1–200 plus colloidal sulphur 2–100), this combination effectively controlling powdery-mildew, holding red-mite in check, and producing fruit noticeably free from russet.

Acknowledgments.

I am indebted to Mr. W. D. Reid, of this Laboratory, for the microphotographs of sulphurs reproduced; to Mr. J. D. Atkinson for conducting work in connection with applications of sulphur to leaves, and estimations of percentages in different precipitation tests; to Mr. W. K. Dallas, for data concerning the field experiments; and to Mr. R. L. Andrew, Dominion Laboratory, Wellington, for information regarding British and American sieve standards.

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HARD-FERN CONTROL BY SPRAYING WITH ARSENIC PENTOXIDE.

EXPERIMENTAL WORK IN CONNECTION WITH REGRASSING SECONDARY-GROWTH COUNTRY AT WHANGAMOMONA.

E. BRUCE LEVY, Agrostologist, and E. A. MADDEN, Assistant in Agrostology, Plant Research Station, Department of Agriculture, Palmerston North.

HARD-FERN (*Paesia scaberula*) is an indigenous weed common on hill country where the annual rainfall is 60 in. or over. It is essentially an induced weed, being in this respect similar to the indigenous piripiri (hutiwai) and the useful native grass Danthonia pilosa.

The spread of these three New-Zealanders may be regarded as induced by the grazing animal, which by controlling all top shade-making growths allows the free access of light to the soil-surface that favours their establishment and spread. Close and continuous grazing, particularly by sheep, and the absence of a good sward of grass, favour alike hard-fern, piripiri, Danthonia pilosa, and, in the country under review, the indigenous manuka as well. Danthonia pilosa is a highly desirable grass on the country here dealt with; piripiri can be controlled by judicious stocking with cattle; manuka control lies in the use of the slash-hook and the firestick, or by hand-pulling in the young stages. Hard-fern may be controlled to some extent by periodical spelling and cleaning up by cattle as in the case of piripiri; when in large clumps it may be partially removed by burning; and these methods undoubtedly are the most practical for dealing with large areas and where the country is difficult.

In what follows it is not expected that spray treatments will supersede stock manipulation methods nor burning on a large scale, but up to the present the writers know of no areas in Whangamomona County which have been entirely cleared of hard-fern once those areas have carried a strong growth of it. There are areas which have been kept free of hard-fern from the time of initial burns

that took place upwards of thirty years ago, before the surface of the country was impregnated with hard-fern spores, but cases are rare of complete control after a bad infestation of the hard-fern growth. The hard-fern may be a phase in the development of this 60-in.-and-over rainfall belt, but the phase is seemingly a long one, and particularly so under sheep grazing rather than cattle. The formation of a dense sward of persistent grasses and clovers is having a big steadying-up effect on the spread of hard-fern, and we are of the opinion that once a dense sward can be secured, and once the ground-surface ages and becomes weathered and dried, there is not the same chance for re-establishment of the fern from spores that may be blown in from neighbouring country.

A dense sward of the hardy grasses can only be secured provided the spread-back of the hard-fern is prevented, and burning the fern reproduces a young soil-surface as against an old, matured soil-surface, thus making possible again re-establishment of the fern from shed spores. For the complete elimination of the ring of growth left after the burn, and for those small centres of reinfestation remaining where the rhizomes were too deeply buried to be killed by the heat of the burn, and for the control of sporelings that appear in the shady aspects, crevices, &c., until the burnt surface matures and ages, some effective method of killing the fern is highly desirable. Then, again, shady faces, where effective burns can scarcely ever be secured, and for those patches too small to carry a fire, pre-killing of the fern growth by spraying makes possible an intensely hot burn that is as efficient when on the shady slope as on the sunny slope.

The Whangamomona Experiments.

Arsenic pentoxide has been experimented with during the past five years at Whangamomona, and the results are sufficiently encouraging to place the spray pump as an additional effective implement for control of this troublesome secondary growth on hill country.

The first area sprayed was on the farm of Mr. A. Coxhead in the autumn of 1926, and a trial strength of 1 lb. of arsenic pentoxide to 30 gallons of water was used.* This strength gave almost complete control of the hard-fern on the small area sprayed. In the autumn of 1927 an area of approximately 20 acres was treated, using a spray strength of 1 lb. arsenic pentoxide to 32 gallons of water (1–320 formula). In the succeeding year trial strengths and monthly spraying trials throughout the entire twelve months were carried out for the purpose of deciding the most economical strength of the arsenic pentoxide to use and the best time of the year for the application.

For these trials a badly infested area was divided up into ¼-acre blocks and sprayed at the following strengths: 1–120, 1–180,

* Arsenic pentoxide is poisonous to stock, and in the initial stages of the investigation it was not known what danger attended the spraying. We wish specially to thank those farmers who took a certain amount of risk in placing fern-infested paddocks at our disposal for treatment, particularly Messrs A. Coxhead, J. McCluggage, A. Perry, and W. Gill.

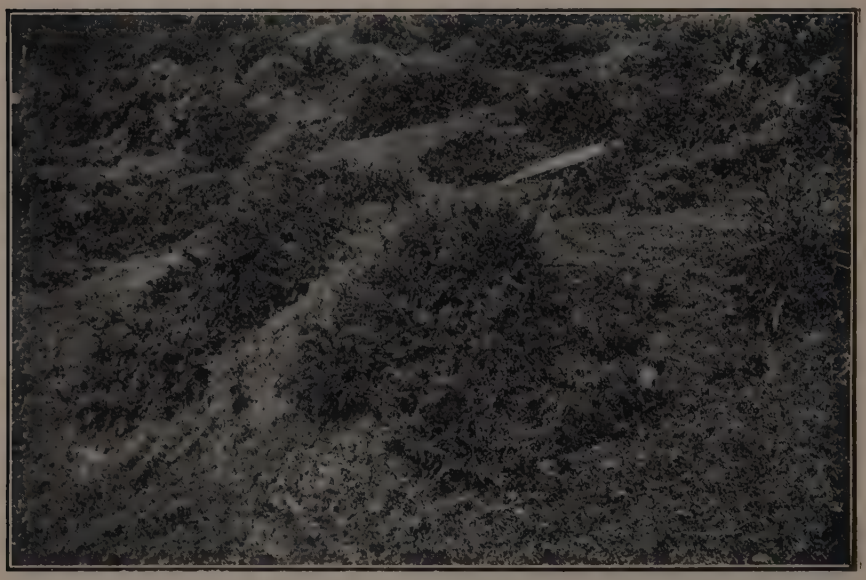

FIG. 1. AREA OF HARD-FERN BURNT AND SOWN IN 1926, AND PHOTOGRAPHED FOUR YEARS LATER.

Showing return of hard-fern despite the fact that a fair sward of brown-top, Lotus major, and danthonia was secured. Experiments with poison-spray materials were inaugurated in 1926 to kill ring-edge and small centres of infection left after the burn.

FIG. 2. SPRAYING HARD-FERN WITH ARSENIC PENTOXIDE ON AN EXPERIMENTAL AREA.

The Vermorel knapsack type of spray-pump is quite suitable for the work, using the fine double nozzle and a good pressure. After being sprayed this area was burnt and sown, and is now, three years later, virtually free of hard-fern.

[*Photos by E. Bruce Levy.*

1–240, 1–300, 1–360, 1–480, 1–560, the foliage in each case being well wetted by the spray. All of these strengths were effective in browning off the fern, and any one area could have carried an intensely hot fire that would have killed any newly developed fronds which had not put in an appearance at the time of spraying. All plots, however, were left unburnt for a full year in order to study subsequent return of fern. The two lighter treatments and the two heavier treatments showed most return growth. This can be explained on the assumption that in the case of the lighter strengths insufficient material was applied to poison effectively, while in the case of the strong solutions immediate contact kill was effected of all parts wetted by the spray, and thus no intake into the sap system of the plant was secured.

This is in accord with numerous poison-spray experiments with plants. Instant-contact kill of foliage sprayed brings about a condition almost synonymous with burning or cutting, in which little or no damage is done to the sub-aerial or root-stock portion of the plant. If just sufficient spray material can be put on to kill the plant gradually the intake of the poison into the system of the plant is secured, and death of root-stock as well as of foliage sprayed results. The practical difficulty, however, in making use of this knowledge is to know how to apply sufficient poison in a sufficiently dilute solution to effect this. In order to penetrate the outer cuticle of the plant moderately strong solutions are necessary, and these, once penetration is effected, kill the tender conducting tissues, so that these are no longer effective as a vehicle of transportation of the poison to the underground root-system.

The weaker strengths used in the trials—the 1–480 and 1–560—are sufficiently strong to kill enough fern fronds to enable a very hot burn to be secured, but they are not effective in killing patches too small to burn. The strength that has given the best results is the 1–320 formula (1 lb. arsenic pentoxide to 32 gallons = 320 lb. of water). Every portion of the hard-fern plant wetted with this strength solution will die.

Directions for Preparation of the 1–320 Spray.

Arsenic pentoxide is soluble in cold water. The required amount of arsenic pentoxide is best dissolved in a moderately small quantity of water and then diluted down to the required strength. The following is a convenient plan:—

Stock solution: Dissolve 1 lb. of arsenic pentoxide in 2 gallons of cold or luke-warm water. Boiling water should not be used, as this decomposes the arsenic pentoxide.

Spray solution: Take 1 quart of stock solution and add this to $3\frac{3}{4}$ gallons water, thus making 4 gallons of solution ready for spraying. Spraying is best done with a knapsack spray-pump of the Eclair Vermorel type, using the fine double nozzles. A good pressure in the pump ensures a finer spray and a more even distribution of the poison. The fern should be well wetted all over, care being taken to spray the edge of each patch well. The fern foliage must be dry prior to spraying, which should be done only in fine weather.

Precautions: As arsenic pentoxide is poisonous all stock should be removed from the paddock being sprayed and kept off for a week or

FIG. 3. HARD-FERN AND SOME TUPARI FERN COMING AWAY ON A DAMP SLOPE, TWELVE MONTHS FOLLOWING THE BURN AND SEEDING-DOWN.

Lotus major is here well established, and provided the hard-fern can be destroyed will effectively cover this slope.

FIG. 4. A SIMILAR ASPECT TO THAT SHOWN IN FIG. 3, WHERE THE HARD-FERN HAS BEEN KILLED BY SPRAYING.

The Lotus major is seen making new growth through the dead fern-fronds.

[*Photos by E. Bruce Levy.*

until rain. It is inadvisable to immerse the hands in the solution, particularly in the stock solution, and leaky pump-hose or taps should be remedied. Constant wetting of the hand leads to painful injury of the quick of the nail. Arsenic pentoxide absorbs moisture from the air; the material should be kept in airtight tins, and the lid replaced when any weighing out has been completed. The strength of the stock solution or any solution weakens on keeping, and only sufficient for the day's work should be made up at any one time. Arsenic pentoxide does not corrode the spray pump, but this and all tins should be well rinsed with water after use.

Time of the Year to Spray.

The results of monthly applications of spray throughout the twelve months of 1928 indicated that, provided fine weather conditions prevailed at the time of spraying and for twelve hours following, all fern fronds were killed and all areas sprayed during the year burnt clean in the autumn of 1929. The most return growth took place on those areas sprayed in winter and early spring, and where the objective is to get a 100-per-cent. kill of isolated small clumps that cannot afterwards be fired spraying is best done from beginning of December to the end of April. Where burning and autumn seeding is to be done following the spray, some three to four weeks should elapse after spraying before the area is fired. Thus all areas to be burnt and sown should be sprayed by the end of February. It must be borne in mind, however, that where an area is sufficiently dense to carry a good fire spraying before the burn is not recommended, except in damp hollows or shady slopes.

After the fire very much less material and labour is required to spray the small unburnt patches and rings that are left where isolated clumps are burned. One spraying is seldom sufficient to get a 100-per-cent. kill, for despite every care some small patches will be missed or inadequately sprayed the first time over. On most of the areas treated two sprayings have resulted in practically 100 per cent. kill, and from our experiences to date it will be a matter of three to four years before a further spraying will be necessary. The first areas sprayed in 1926 to 1928 are still practically free of hard-fern.

Economics of the Practice.

The first two years' work proved the efficacy of the spray method of dealing with hard-fern, but some years will be necessary before the economics of the practice can be gauged at all accurately. Approximately 170 acres of country have been experimentally treated at Whangamomona, and of this 72 acres have had two applications of spray. The relative cost of the material is very low, and 1s. per acre may be put down as a conservative figure. The main cost is the labour and the packing of water on to the area. Given a good pack-horse, and with water moderately handy, two men should do 4 acres in one day.

On one area four men working for seven days of about six hours and a half each did approximately 50 acres of moderately infested country and used for this area 28 lb. of arsenic pentoxide. On another area of 11 acres, spraying return growth three years after burning and sowing took one man thirteen days, and 11 lb. of arsenic pentoxide was used. Water on this area was difficult of access, and too much time was taken

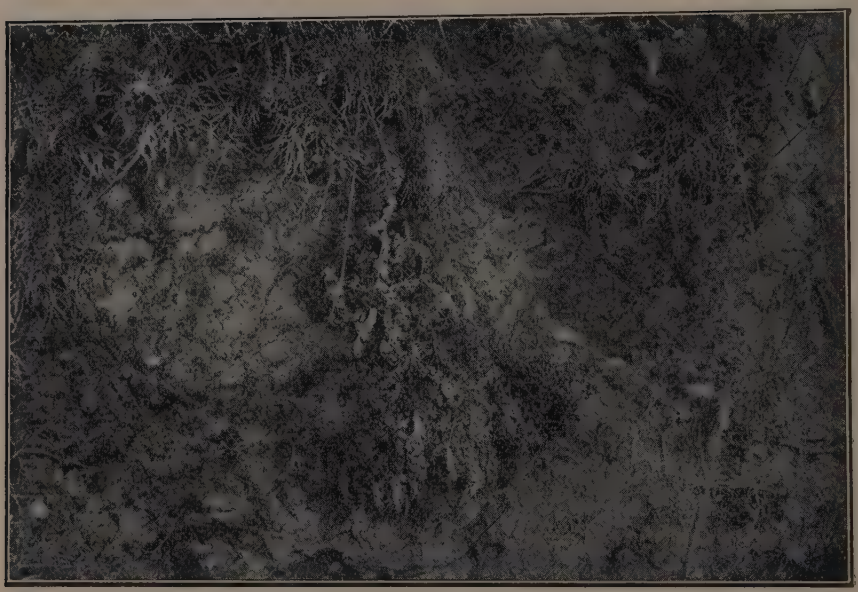

FIG. 5. SMALL ISOLATED HARD-FERN PATCH ON A BARE SLOPE EFFECTIVELY KILLED BY SPRAYING WITH ARSENIC PENTOXIDE.

Without spraying it is impossible to deal with these small clumps until they have spread and occupied a considerable area.

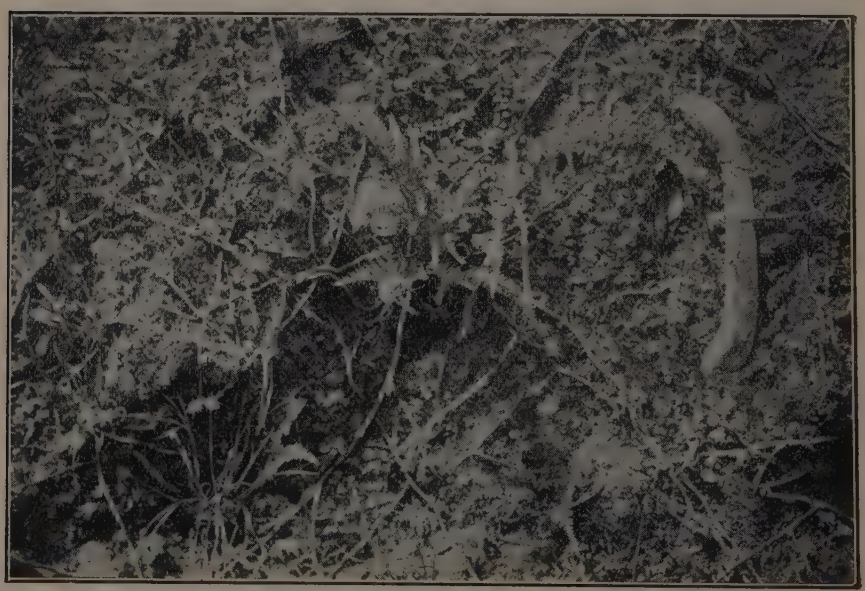

FIG. 6. HARD-FERN BURN (NOT SOWN) SHOWING SMALL CENTRE OF THE FERN WHERE THE FIRE WAS NOT SUFFICIENTLY HOT TO KILL ALL RHIZOMES.

Below may be seen two sporelings of hard-fern. Spraying at this stage kills 100 per cent. of these small fern-growths.

[*Photos by E. Bruce Levy.*

up in packing. In a small rather heavily infested paddock of 6 acres 15 lb. of arsenic pentoxide was used, and it took one man three days to spray this area. The area was burnt and sown, and some months later gone over a second time, when less than ½ lb. of arsenic pentoxide was used and two hours completed the work. At the present time, four years later, this area is practically free of hard-fern. A 5-acre block burnt and sown in 1924 and reburnt in 1928 was sprayed twice, once soon after the 1928 burn and again in May of the same year. Eleven pounds of arsenic pentoxide were used over the two sprayings, which took two men eight days. Practically no hard-fern showed on this area at the end of 1931, as may be seen by reference to Fig. 7 on page 86 of last month's *Journal*. A lighter infested area of 20 acres took 10 lb. arsenic pentoxide for two sprayings—8½ lb. for the first time over and 1½ lb. for the second treatment—and the time taken was eleven days for one man.

Haulage of water is one of the main considerations, and if some means of water storage on hill country to be treated could be devised the greatest objection to this method of control would be overcome. Given water handy, spraying with a knapsack spray-pump on hill country is not exceedingly laborious.

It will be obvious from the foregoing examples that the labour cost far exceeds that of the material. On the type of country and stage of fern growth where spraying is recommended, the per-acre cost for material should not exceed 1s. As regards labour, this hill-country spraying may have to be included with many other jobs on the farm that cannot be reckoned at so much per hour of the farmer's time.

"NUTRITION ABSTRACTS AND REVIEWS."

AGRICULTURAL scientific workers in the British Empire have in the past two years been brought into closer touch one with the other than ever before by means of Imperial bureaux attached to a Central Council on which sit representatives of various parts of the Empire and from the bureaux. As each bureau becomes established it is issuing précis of all published papers coming within its particular scope. In the case of the Bureau of Animal Health and the Bureau of Animal Nutrition these have become regular publications, the former named the *Veterinary Bulletin* and the latter *Nutrition Abstracts and Reviews*.

The first issue of *Nutrition Abstracts and Reviews*—issued under direction of the Imperial Agricultural Bureaux Council, Medical Research Council, and the Reid Library—which came to hand recently, is a paper-covered volume of 351 pages, together with an authors' index. It is edited by Dr. J. B. Orr, who is in charge of the Rowett Institute, Aberdeen, Professor J. J. R. McLeod, of Aberdeen University, and Dr. Hariette Chick, of the Lister Institute, London, together with a number of assistant editors. Four hundred and fifty periodicals are reviewed, and papers of interest are extracted and summarized. The *Journal* commences its service with literature published in January, 1931. Papers abstracted take in all phases of nutrition in animals and in man, and consequently there is bound to be some overlapping of subjects dealt with by other bureaux. The editors have arranged subjects in sections dealing with technique, composition of foodstuffs, physiology of nutrition, dietetics, feeding of animals, and diet in relation to health and disease. Also included are reviews by men thoroughly versed in the subjects dealt with, and it is intended in such reviews to give bibliographies. The annual subscription is 21s.

The New Zealand representatives of the Bureau of Animal Nutrition are Dr. J. Malcolm, Professor of Physiology, Medical School, Dunedin, and Mr. B. C. Aston, Chief Chemist of the Department of Agriculture, Wellington.

DISTRIBUTION OF MEDULLATED FIBRE IN NEW ZEALAND ROMNEY FLEECES.

FLEECE-SAMPLING FOR THE BENZOL TEST.

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In February, 1931, the writer discussed in this *Journal*(1) the nature and significance of the medullated fibres which are present in the fleeces of so many of the Romney flocks of New Zealand. It was pointed out that although it is only the strongly medullated or really hairy fibres that are distinctly objectionable to the textile manufacturers, yet the finely medullated fibres, difficult or impossible to detect by the naked eye, are almost as undesirable from the breeders' point of view, since they represent a taint in the blood which is liable to be perpetuated and intensified in the flock if not culled out.

There is sufficient breeding experience to support the statement that strong medullation is largely hereditary in its nature, so that it can be bred out by selection; and there is every reason to suppose that this applies equally to slight medullation. These are points, however, which have not yet been settled conclusively by scientific investigation.

The new benzol test which makes simple and infallible the detection of even the slightest trace of medullated fibre in a staple, was then described; and in May, 1931, details of a simplified wool-testing equipment, suitable for use on the farm, were published(2). Full details and precautions for carrying out the test were given, so that breeders themselves could make use of the new method of examination in selecting their breeding-stock.

It should be noted that medullated fibre is produced by all our common breeds of sheep, even the Merino, and that the benzol test is applicable as an aid in the selection of all these breeds. It is satisfactory to be able to report that already about 150 stud-flock owners have availed themselves of the arrangements made by Massey Agricultural College to supply complete outfits for the carrying-out of the test.

It was also recorded(1) that the first fleece examinations made by means of the benzol test disclosed the quite unexpected fact that adjacent staples frequently differ to an extraordinary extent in their degrees of medullation. So much so, that a few isolated medullated staples may sometimes be found in an otherwise non-medullated part of the fleece, and *vice versa*. Furthermore, although it was generally known that medullation is more pronounced in the britch than elsewhere, no definite information had ever been published, so far as the writer was aware, on the mode of distribution of medullation over the Romney fleece as a whole. Attention was drawn to the difficulties arising from this source, but no recommendations for sampling could then be made.

It will be obvious that a fleece cannot be judged from the nature of one staple alone, and that in order to use the benzol test for ascertaining the relative merits of two fleeces, as regards their content of medullated fibres, one must be able to obtain a truly representative

sample of each fleece in as small number of staples as possible. The question that immediately presents itself is: How many staples must be taken from a fleece, and from which parts, in order to obtain a satisfactory sample of the fleece?

Experiments on the Distribution of Medulla in the Fleece.

Experiments have been conducted with a view to answering the above question. The first essential was to ascertain as exactly as possible the manner in which medullation disposes itself over the fleece; and as this involves an extremely detailed examination of each fleece studied, it has not yet been possible to extend this examination to a large number of fleeces.

The following results refer to the fleeces of seven Romney crossbred ewes, selected more or less at random from the college flock. Four were sampled in November, 1930, as hoggets, and three in September,

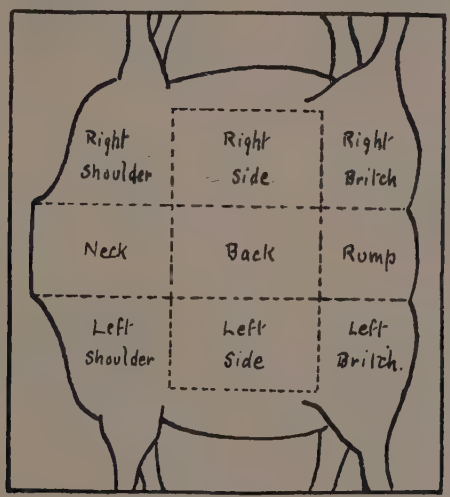


FIG. 1. SHOWING MODE OF DIVISION OF FLEECE INTO AREAS FOR SAMPLING.

1931, as two-tooth ewes. The term "more or less at random" is used because it was necessary, before a very detailed examination was embarked upon, to ensure, by means of a preliminary rough survey, that each animal selected had a reasonable amount of medullated fibres in its fleece. Apart from this no conscious selection of the animals used for the experiment was made. A further fifteen fleeces have been sampled in extreme detail this season, but their examination is being deferred pending the development of a better means of assessing the results.

For convenience each fleece was divided into nine roughly similar areas. The hip bones were used as points of reference, and vertical and horizontal lines were drawn from these points. The mode of division is illustrated in Fig. 1.

Each area was then sampled separately, as many in some cases as thirty-six staples, but never less than twelve staples, being cut from

evenly distributed and carefully noted positions within each area. Each staple was labelled and packed separately. Such complicated sampling as this is, of course, necessary only for the purposes of such experiments as these. The detailed and exact information thereby gained is needed to furnish a reliable basis for the very much simpler method of sampling recommended below for ordinary fleece-examination. The technique of sampling will be dealt with in a subsequent article.

Each staple was then tested by means of the benzol test, and a value awarded to each based on personal judgment of its degree of medullation. Account was taken, in an arbitrary manner, of both the coarseness of the medulla present and the percentage of fibre in the staple so affected, and the results were combined into a single value, with a possible maximum of 300. In this way an attempt was made to translate the visual impressions given by the test into numerical values, for in no other way could comparisons of a large number of staples be made and recorded.

The numerical expression of the degree of medullation of a staple from its appearance under the benzol test presents a difficult and complicated problem, which has not yet been satisfactorily solved. A discussion of the difficulties involved and the proposed means of overcoming them will be given in a second article.* The method used for this experiment, while it is not strictly accurate, has served its purpose in enabling the classification of the staples to be made, so that fleece maps could be drawn, showing the distribution of medulla in the fleeces examined (see Fig. 2).

Each black dot marks the position of a tested staple, small groups of dots representing bundles of adjacent staples. The areas covered with single shading are those in which the staples tested possessed more than a slight trace of medullation. The areas covered with double shading are those in which the staples tested received values of 100 or more out of 300; and they cover roughly those parts of the fleeces in which the wool was hairy to the naked eye.

Parts of the unshaded areas were free of even the slightest trace of medulla, especially on the neck area (as defined in Fig. 1), *the last stronghold of pure wool;* while the remaining parts possessed various slight and relatively insignificant amounts of medullation unevenly distributed. Fig. 3 illustrates this by showing the actual value assigned to each staple of one of the fleeces.

A study of these seven fleece maps, arranged in order of increasing degrees of medullation, shows that medullation is distributed over them according to a simple rule which may be stated as follows: With increasing degrees of medullation the area affected spreads from the britch only, the flank being invaded before the rump, the rib before the back, and the shoulder before the wither, the last-named area being the least likely of all to be medullated. Furthermore, no striking differences between the two sides of an animal are indicated.

This rule may not apply to aged sheep, about which no definite information has yet been obtained.

* It is proposed to publish this in next month's (April) issue of the *Journal*.—Ed.

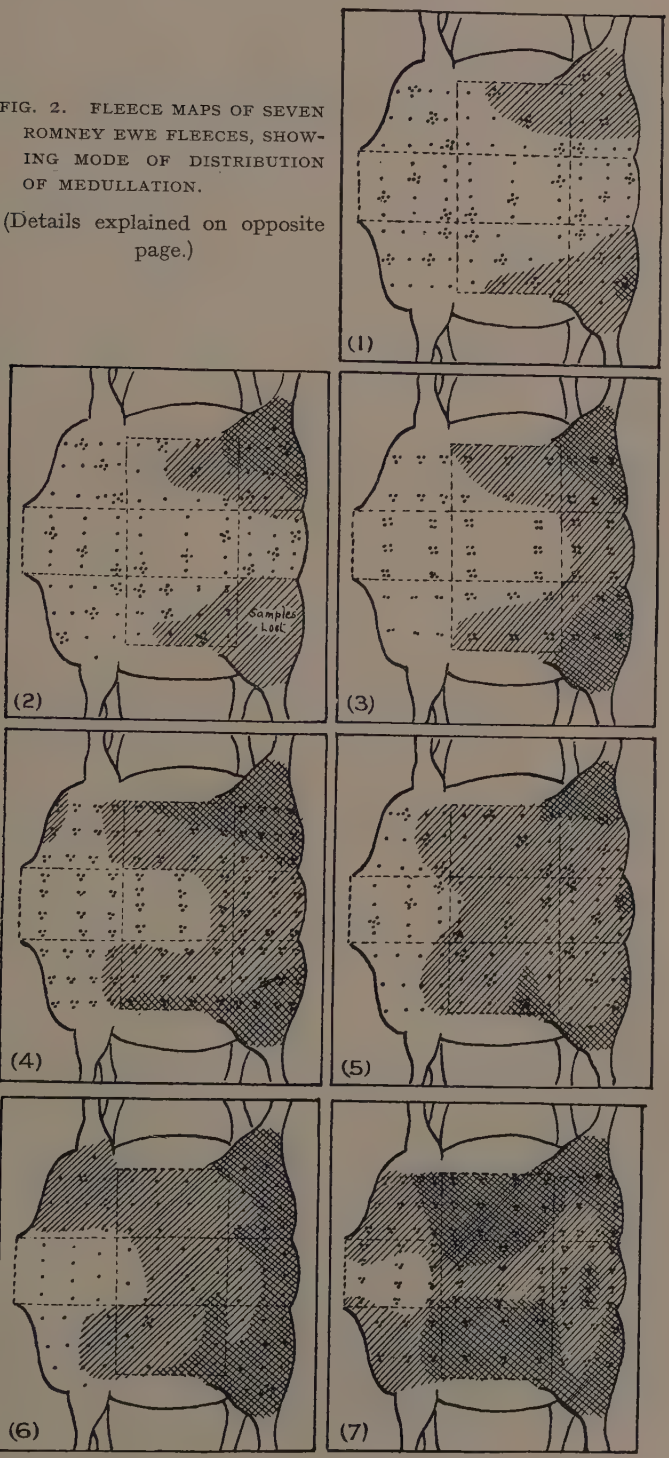


FIG. 2. FLEECE MAPS OF SEVEN ROMNEY EWE FLEECES, SHOWING MODE OF DISTRIBUTION OF MEDULLATION.

(Details explained on opposite page.)

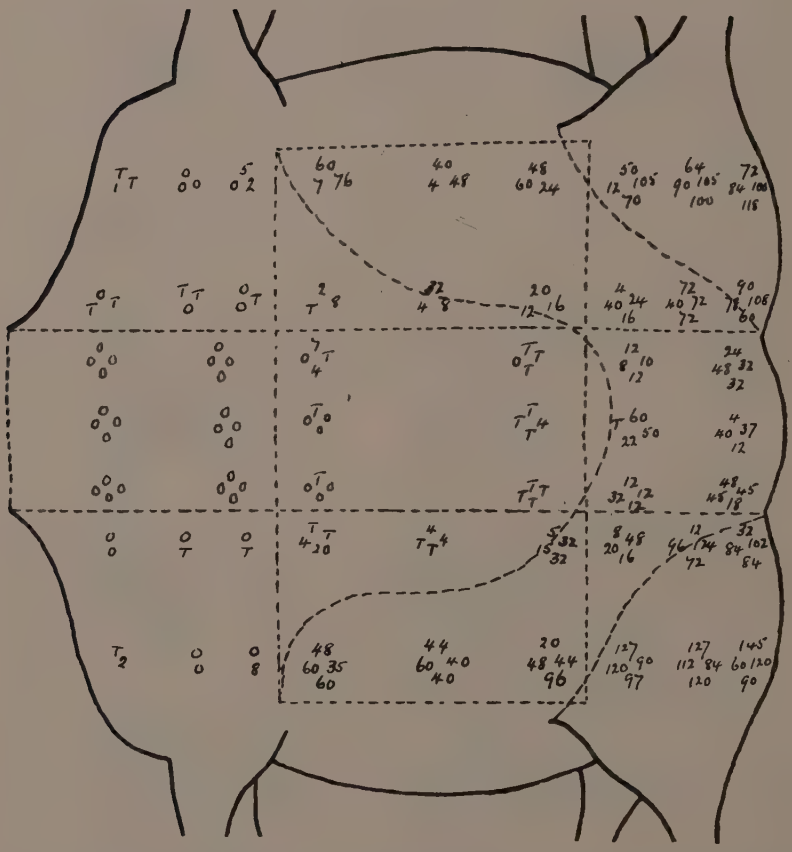


FIG. 3. SHOWING TESTS OF 192 STAPLES FROM A ROMNEY TWO-TOOTH EWE FLEECE.
Degrees of medullation are awarded to each staple out of a maximum of 300. "T" signifies trace only.

It must be realized that final conclusions cannot be drawn from the examination of seven fleeces, and that these results require confirmation by a similar examination of a larger number of fleeces from several different Romney flocks. However, the fact that these fleeces were selected at random, and that they fall into so simple and orderly a progression, suggests that the results are significant and useful pending the accumulation of further experimental data.

Fleece-sampling.

The conclusions that may be drawn tentatively from the above results are that fleece-sampling may be confined to the britch, side, and shoulder wools on one side of the animal, and that over those areas one may confidently expect the wool to improve regularly in its freedom from medullation as one advances toward the shoulder.

The actual method of sampling to be employed must depend on whether or not the staples are being tested on the spot. In the case of a breeder testing his own flock, the testing of the staples will usually be carried out in the yards or wool-shed at the time of sampling, and accordingly the extent to which any particular fleece is sampled will depend on the individual circumstances. Thus in some cases the first few staples to be tested may either condemn the animal straight away or raise it above suspicion, so that further testing would be unnecessary. In other cases further examination would be required.

And here each breeder who is endeavouring to eradicate hairy fibre will have to make his own decision as to the extent to which he can afford to eliminate medullation from his flock, or, in other words, as to the point at which he must for the time being be content to draw the line in his discrimination against medullation. For it is certain that the introduction of the benzol test is revealing that medullation is far more common a feature than was supposed, and there are probably few Romney flocks to-day from which it would be economically possible to cull out straight away all fleeces containing *some* medullation.

In view of this fact, and also with due regard to the controversy over the question of whether or not it is desirable to eliminate medullation from the britch wool, it may be advisable, for the time being, to direct attention mainly toward improving the uniformity and freedom from medullation of the main body of the fleece, apart from the britch. This is a matter which cannot be settled by a few short experiments, and on which time alone can pronounce a verdict.

However, on this basis the flank becomes the critical point for examination, since this is the first point to which medullation is shown to spread from the confines of the britch. Hence, the first samples should be taken from this area. If the flank is found to be free of medullation, then the whole of the rest of the fleece, with the exception of the britch, is presumably also free, while the britch may or may not be free. If the flank is not free it should then be the aim to find out how far along the side of the animal the medullation has spread. Thus, next the rib and finally the shoulder wool should be tested.

As emphasized already, one staple cannot give a reliable picture of any one of these areas, and in the writer's opinion, based on the examination of a large number of fleeces, never less than four evenly distributed staples should be taken and tested from any one area. In some cases these may be all the same ; but in other cases they will be all different, and quite erroneous conclusions would then be drawn by testing one staple only.

As continuous attention to the elimination of medullated fleeces steadily improves the average standard of the flock in this respect, so it will become possible, if desired, to impose a stricter standard in the process of selection, while at the same time the care and detail required in fleece-sampling would become correspondingly greater.

When the testing of the staples is not being carried out on the spot, then the process of sampling must be cast into a uniform standard procedure capable of dealing satisfactorily with any fleece likely to be encountered. In this case all three areas—britch, side, and shoulder—

must be sampled regardless of their nature, and a sufficient number of staples must be taken from each area to be certain of obtaining a representative sample of that area. Further information on this aspect of the subject will be given when dealing with large-scale flock-testing in the forthcoming second article.

It must be remembered that the conclusions presented above with regard to fleece-sampling depend so far on the study of only a very few fleeces, and therefore they cannot at present be regarded as anything but tentative. They are published now because they do represent a decided advance in our knowledge of the Romney fleece, and because, though provisional, they may serve as a helpful guide to breeders in their own flock-testing. However, the possibility of exceptions to the rules now given must not be overlooked.

An extension of this work to a larger number of fleeces from different flocks is now in hand, and all the evidence so far available is in support of the conclusions presented in this article. The same animals will also be examined year after year, so that accurate information may be obtained on the relative amounts of medullation occurring in the successive fleeces of the same sheep. Results on this work will be published from time to time as they become available.

Summary.

The importance of selecting against the presence of medullated fibres in the New Zealand Romney fleece is being appreciated, and a large number of stud-breeders are now using the benzol test in selecting their breeding-stock.

The question of selecting fleece-samples has been complicated by the facts (1) that adjacent staples in the fleece often differ greatly in their degrees of medullation, and (2) that no precise information has been available as to the mode of distribution of medullation over the Romney fleece.

The fleeces of seven Romney hogget and two-tooth ewes, selected at random, were sampled in great detail (up to 324 staples per fleece), the staples tested by the benzol test, and fleece maps drawn showing the distribution of medullation. The results consistently suggest the following rule :—

With increasing degrees of medullation, the area affected spreads from the britch only, the flank being invaded before the rump, the rib before the back, and the shoulder before the wither, the last-named area being the least likely of all to be medullated. No striking differences between the two sides of an animal are indicated.

It is concluded provisionally that the britch, side, and shoulder wool on one side of the sheep give a true indication of the nature of the whole fleece, while not less than four evenly-spaced staples should be taken as a sample from any one of these areas.

Accepting the present doubt as to the advisability of eliminating medullation from the britch, and concentrating on the improvement of the rest of the fleece, the flank becomes the critical point for examination.

References.

(1) "Medulla in Wool." B. L. Elphick. *N.Z. Jour. of Agri.*, Feb., 1931.
(2) "A Simple Wool-testing Outfit." B. L. Elphick. *N.Z. Jour. of Agri.*, May, 1931.

TURNIP-MANURING EXPERIMENTS IN THE SOUTH ISLAND.

SUMMARY OF RESULTS FOR SEVEN SEASONS, 1924–25 TO 1930–31.

Fields Division, Department of Agriculture.

DURING the past seven years fifty-eight turnip or swede manuring experiments have been conducted in the South Island by the Fields Division, and the salient features of these are here presented.

A description of the work and a discussion of the results obtained was published in the *Journal* for October, 1928(1)*. The chief findings up to the end of the 1927–28 season were as follows :—

(1) Superphosphate at 1 cwt. per acre gave decidedly better yields than Ephos or Nauru phosphates.

(2) A mixture of super and Ephos in equal parts at 1 cwt. per acre was practically as effective as 1 cwt. of super.

(3) Germination injury caused by super increased as the quantity in contact with the seed increased.

(4) Predrilling of most of the super, followed by sowing a small amount with the seed across the direction of the predrilling, had given promising results.

(5) Sowing seed and manure in 7 in. rows, instead of adopting the more common practice of sowing in 14 in. rows, gave promise of good results, especially if the rate of seeding was increased.

(6) Mixing super with an equal quantity of carbonate of lime reduced injury to germination, and had caused a substantial increase in yield in one experiment. Farmers' experience indicated that this was good practice also.

A number of the above findings have been put to further test since 1927–28. Recommendations to farmers based on the results of the first six years' experimental work appeared in the *Journal* for November, 1930(2).

In both the above-mentioned articles, (1) and (2), the injury to germination caused by super and the subsequent reduction in yield were discussed. It was mainly with the object of eliminating this germination injury and at the same time increasing yield that the experiments under review were planned. The objects of the experiments in brief were as follows :—

(1) To determine the extent of the germination injury caused by using 1 cwt. or 2 cwt. of super respectively, and to investigate the possibility of overcoming this injury and increasing yield by mixing the super with carbonate of lime or rock phosphate (Ephos was the rock phosphate used in nearly all trials). At the Gore Experimental Area, where sowing on ridges is the practice, super was used at the rate of 3 cwt. per acre, varying quantities with and below the seed being used.

* Small figures in brackets indicate references at end of article.

(2) To determine the effect on germination and yield of mixing super and carbonate of lime for different times before sowing.

(3) To compare the effect of commercial basic super with the mixture of super plus carbonate of lime, and super plus slaked lime, on germination and yield.

(4) To compare 14-in.-row sowing with 7-in.-row sowing.

(5) To investigate methods of sowing super with the seed so that contact of seed with manure is minimized.

(6) To test the effect of nitrogenous and potassic fertilizers with the seed, postdrilled and predrilled.

All plots in the experiments were replicated so that yield could be examined statistically by "Student's" method. The method of conducting experiments when sowing on the flat was described in the *Journal* for July, 1926([3]).

The method of determining field germination was described in the *Journal* for July, 1926([3]), and October, 1928([1]). The extent of the germination injury caused by superphosphate is indicated by the following: The average of thirty-one trials conducted up to the present time in which plots receiving 1 cwt. super per acre (seed and manure in 14 in. rows) could be compared with plots receiving no manure, ground rock phosphate, or super plus carbonate of lime (equal parts) shows that the super reduced the germination to 65·5 per cent. of that occurring with other treatment mentioned. Super at 2 cwt. per acre had a still greater effect on germination when sown with the seed in 14 in. rows. A comparison of super 2 cwt. with plots sown with super 2 cwt. plus lime 2 cwt. in fourteen experiments shows that the germination of super 2 cwt. was 43·2 per cent. of that in the super plus lime plots. Almost total killing was caused in one experiment.

1. Results obtained from Super at 1 and 2 cwt. per Acre, Mixture of Super and Carbonate of Lime, and Mixture of Super and Ephos.

All the experiments discussed under this heading, except two, were conducted in Canterbury. Two were carried out in North Otago in 1930–31.

(1) SUPER 1 CWT. COMPARED WITH MIXTURE OF SUPER 1 CWT. PLUS CARBONATE OF LIME 1 CWT. PER ACRE.

In nearly all cases the mixing of the super and lime was done from one week to several weeks before sowing.

(*a*) *Seed and Manure in 14 in. Rows.*—Super 1 cwt. has been compared directly with super 1 cwt. plus carbonate of lime 1 cwt. in twenty-four experiments conducted during 1928–29 to 1930–31 inclusive, with the following results:—

	Average Field Germination: Plants per Area 10 ft. by 14 in.	Average Yield in Tons per Acre.
Super 1 cwt. per acre	9·9	11·7
Super 1 cwt. plus carbonate of lime 1 cwt. per acre	17·1	15·1
Difference	42 per cent.	3·4

The germination on super plots is 42 per cent. less than that on plots sown with super plus lime. The increase in yield due to super plus lime is undoubtedly due to the greater number of plants and their more even distribution resulting from elimination of injury to germination.

(*b*) *Seed and Manure in 7 in. Rows.*—Seven experiments are available for this comparison, the results being :—

	Average Field Germination : Plants per Area 10 ft. by 14 in.	Average Yield in Tons per Acre.
Super 1 cwt.	.. 21·2	15·5
Super 1 cwt. plus carbonate of lime 1 cwt. per acre	26·6	16·2
Difference	20 per cent.	0·7

The reduction in germination caused by super in this case is 20 per cent. The difference in yield is slight. Since twice as many 7 in. rows are sown as when 14 in. rows are used, and the rate of sowing of manure per acre is the same, it must be remembered that only half as much manure is in contact with the seed when 7 in. rows are used.

NOTE.—In this and all other comparisons, except in Section 4, the germination and yields of 14-in.-row sowings cannot be compared with germination and yields of 7-in.-row sowings, as different experiments are represented in the averages of the two. Most of the experiments in which the turnips were sown in 7 in. rows were located in South Canterbury where, in addition to the sowing through every coulter of the drill being common practice, the rate of seeding is usually higher than in other parts of Canterbury. Hence the number of plants per area of 10 ft. by 14 in. is, throughout this report, usually higher in the case of sowings in 7 in. rows than in 14 in. rows. Although germinations and yields of the 14-in.-row sowings cannot be compared with germinations and yields of the 7-in.-row sowings, the *differences* shown, in relation to the actual germinations and yields indicate the relative effect of the treatments.

(2) SUPER 1 CWT. COMPARED WITH SUPER 2 CWT. PER ACRE.

(*a*) *Seed and Manure in 14 in. Rows.*—Eleven experiments are available in which super 1 cwt. has been compared directly with super at 2 cwt. per acre. The results are as follow :—

	Average Field Germination : Plants per Area 10 ft. by 14 in.	Average Yield in Tons per Acre.
Super 1 cwt.	.. 9·8	11·1
Super 2 cwt.	.. 6·6	11·1
Difference	.. 30 per cent.	..

Plots receiving super 2 cwt. have germinated 33 per cent. less than those receiving 1 cwt. per acre. The average yields are identical. Compare this with (3*a*) below, where super 2 cwt. plus carbonate of lime 2 cwt. per acre have given a substantial increase in yield over super 2 cwt. Apparently the number of plants on super 2 cwt. plots is too few to take full advantage of the manure applied, but when germination injury is eliminated and the number of plants increased, better utilization of the manure is reflected in an increase in yield. This applies also to (2*b*) below, where germination injury is reduced by having less super in contact with the seed.

(*b*) *Seed and Manure in 7 in. Rows.* — Six experiments give the following averages :—

	Average Field Germination: Plants per Area 10 ft. by 14 in.	Average Yield in Tons per Acre.
Super 1 cwt.	26·6	18·5
Super 2 cwt.	22·8	19·8
Difference	14 per cent.	1·3

By doubling the number of rows and halving the manure per row, super at 2 cwt. per acre gives a germination of 14 per cent. less than that of super 1 cwt. in six experiments. Although the number of plants is reduced by the greater quantity of super, there are still enough plants to take advantage of the extra manure, and an increase in yield of 1·3 tons per acre has resulted from the heavier dressing.

(3) SUPER 2 CWT. COMPARED WITH SUPER 2 CWT. PLUS CARBONATE OF LIME 2 CWT. PER ACRE.

(*a*) *Seed and Manure in 14 in. Rows.* — Thirteen experiments lend themselves to comparing the above treatments. The average results are :—

	Average Field Germination: Plants per Area 10 ft. by 14 in.	Average Yield in Tons per Acre.
Super 2 cwt.	7·6	9·5
Super 2 cwt. plus carbonate of lime 2 cwt. ..	15·7	14·1
Difference	52 per cent.	4·6

In the above experiments the average germination of super 2 cwt. plots is about 52 per cent. less than that of super plus lime. The greater number of plants in the latter have yielded 4·6 tons per acre more than the smaller number of plants on the super 2 cwt. plots.

(*b*) *Seed and Manure in 7 in. Rows.*—Six experiments are averaged in this case, the results being :—

	Average Field Germination: Plants per Area 10 ft. by 14 in.	Average Yield in Tons per Acre.
Super 2 cwt.	20·6	19·1
Super 2 cwt. plus carbonate of lime 2 cwt. ..	29·0	21·6
Difference	29 per cent.	2·5

Halving the amount per row by doubling the number of rows shows much less injury due to super, which has germinated 29 per cent. less than super plus lime. The result on yield is in favour of super plus lime to the extent of 2·5 tons per acre. Although the plants on the super 2 cwt. plot would appear to be thick enough (practically two plants per square foot) the greater number of plants on super plus lime has again proved superior. It is probable that this superiority is not so much due to the greater number of plants in this case as to the fact that the individual plants do better. In addition to germination injury heavy dressings of super in contact with the seed retard the development of the young plants quite markedly in their early growth. It would appear that this is due to a too concentrated soil-solution tending towards plasmolysis of the plants. Presumably the lime reduces the solubility of the super to some extend at least, although its efficacy is obviously not impaired.

(4) SUPER 1 CWT. PLUS CARBONATE OF LIME 1 CWT. COMPARED WITH SUPER 2 CWT. PLUS CARBONATE OF LIME 2 CWT. PER ACRE.

(*a*) *Seed and Manure in 14 in. Rows.* — Seventeen experiments are available for comparing the above manures, with the following results :—

	Average Field Germination : Plants per Area 10 ft. by 14 in.	Average Yield in Tons per Acre.
Super 1 cwt. plus carbonate of lime 1 cwt. ..	16·4	15·3
Super 2 cwt. plus carbonate of lime 2 cwt. ..	16·1	17·0
Difference		1·7

There is no appreciable difference in the germination following the two treatments. The average increase of 1·7 tons per acre is made up of increases ranging from 0·3 tons to 4·6 tons per acre, with one exception where there was no difference. Broadly speaking, the bigger increases from the heavier dressing were obtained on the better-class turnip land as represented by that in the vicinity of Waddington and Sheffield. These results should be compared with those under (2*a*), where super 2 cwt. is no better than super 1 cwt. The heavier dressing of super is of no advantage on the average when sown in 14 in. rows unless accompanied by the use of lime to overcome the undesirable effects on germination and growth of young plants.

(*b*) *Seed and Manure in 7 in. Rows.* — The average results for ten experiments are as follow :—

	Average Field Germination : Plants per Area 10 ft. by 14 in.	Average Yield in Tons per Acre.
Super 1 cwt. plus carbonate of lime 1 cwt. ..	24·2	17·8
Super 2 cwt. plus carbonate of lime 2 cwt. ..	24·4	19·5
Difference		1·7

The two treatments have given virtually the same germination, and the average increase from the heavier manuring is the same as in (4*a*) above—namely, 1·7 tons per acre. In one experiment the super 2 cwt. and lime 2 cwt. was 0·2 ton lower in yield than super 1 cwt. and lime 1 cwt., but in the others the increases ranged from 0·5 to 4·8 tons per acre. No really light land is represented in this series, and there does not appear to be any consistent superiority from the heavier dressings on the better-class land over its effect on the medium-class soils.

(5) SUPER 2 CWT. COMPARED WITH SUPER 1 CWT. PLUS EPHOS 1 CWT. PER ACRE.

(*a*) *Seed and Manure in 14 in. Rows.*—The results of ten experiments are averaged with the following results :—

	Average Field Germination: Plants per Area 10 ft. by 14 in.	Average Yield in Tons per Acre.
Super 2 cwt.	6·1	10·3
Super 1 cwt. plus Ephos 1 cwt. ..	11·3	13·5
Difference	46 per cent.	3·2

Super at 2 cwt. has given an average germination about 46 per cent. less than that from the mixed phosphates. The yield is 3·2 tons per acre in favour of the latter.

(*b*) *Seed and Manure in 7 in. Rows.*—Only three experiments are available for comparison in this case.

	Average Field Germination: Plants per Area 10 ft. by 14 in.	Average Yield in Tons per Acre.
Super 2 cwt.	25·9	23·2
Super 1 cwt. plus Ephos 1 cwt.	28·8	21·6
Difference	10 per cent.	1·6

The germination on the super plots is 10 per cent. less than that on the super plus Ephos ones. The average yield is in favour of the super in this case, where the concentration of the super is only half that of (5*a*) above.

(6) SUPER 2 CWT. PLUS CARBONATE OF LIME 2 CWT. COMPARED WITH SUPER 1 CWT. PLUS EPHOS 1 CWT. PER ACRE.

(*a*) *Seed and Manure in 14 in. Rows.*—Ten experiments are averaged with the following results:—

	Average Field Germination: Plants per Area 10 ft by 14 in.	Average Yield in Tons per Acre.
Super 2 cwt. plus carbonate of lime 2 cwt. ..	16·2	15·8
Super 1 cwt. plus Ephos 1 cwt.	11·3	13·5
Difference	30 per cent.	2·3

The super plus Ephos mixture has germinated about 30 per cent. less than the super 2 cwt. plus lime 2 cwt. plots. Consideration of this comparison and (7*a*) below indicates that the injury to germination is more or less proportionate to the amount of super in the mixture of the super and Ephos. Mixing super with a rock phosphate such as Ephos does not lessen the injurious effect of the super itself on germination to an appreciable extent.

(*b*) *Seed and Manure in 7 in. Rows.*—The averages for three experiments are as follow:—

	Average Field Germination: Plants per Area 10 ft. by 14 in.	Average Yield in Tons per Acre.
Super 2 cwt. plus carbonate of lime 2 cwt. ..	30·5	22·8
Super 1 cwt. plus Ephos 1 cwt.	28·4	21·6
Difference	7 per cent.	1·2

The average germination in the super and Ephos treatment is about 7 per cent. less than that in the super plus lime. Halving the manure per row and doubling the number of rows again reflects the reduction in germination injury from the super in the mixed phosphates as a result of having a lesser amount in contact with the seed. There is an advantage in yield from the super plus lime mixture.

(7) SUPER 2 CWT. PLUS CARBONATE OF LIME 2 CWT. COMPARED WITH SUPER 1 CWT. PLUS EPHOS 1 CWT. PLUS CARBONATE OF LIME 1 CWT. PER ACRE.

(*a*) *Seed and Manure in 14 in. Rows.*—The results of ten experiments in which the above treatments were used give the following averages:—

	Average Field Germination: Plants per Area 10 ft. by 14 in.	Average Yield in Tons per Acre.
Super 2 cwt. plus carbonate of lime 2 cwt. ..	16·2	15·8
Super 1 cwt. plus Ephos 1 cwt. plus carbonate of lime 1 cwt.	15·6	14·7
Difference		1·1

The addition of lime to the super plus Ephos mixture has resulted in average germination very similar to that from super plus lime. This should be compared with (6*a*) above, where super plus Ephos without the addition of lime germinated 30 per cent. less than super plus lime.

(*b*) *Seed and Manure in 7 in. Rows.* — Only three experiments are available for averaging, the results being :—

	Average Field Germination: Plants per Area 10 ft. by 14 in.	Average Yield in Tons per Acre.
Super 2 cwt. plus carbonate of lime 2 cwt. ..	30·5	22·8
Super 1 cwt. plus Ephos 1 cwt. plus carbonate of lime 1 cwt.	30·7	22·2
Difference		0·6

The differences between the two treatments are very small, and in none of the experiments were they significant. In two cases the results were in favour of super plus lime, and in the other slightly in favour of super plus Ephos plus lime.

(8) SUPER 1 CWT. PLUS EPHOS 1 CWT. COMPARED WITH SUPER 1 CWT. PLUS EPHOS 1 CWT. PLUS CARBONATE OF LIME 1 CWT. PER ACRE.

(*a*) *Seed and Manure in 14 in. Rows.*—Ten experiments are averaged in this case.

	Average Field Germination: Plants per Area 10 ft. by 14 in.	Average Yield in Tons per Acre.
Super 1 cwt. plus Ephos 1 cwt.	11·3	13·5
Super 1 cwt. plus Ephos 1 cwt. plus carbonate of lime 1 cwt.	15·6	14·7
Difference	28 per cent.	1·2

The super plus Ephos has given 28 per cent. lower germination than when lime is added. The yields are in favour of the mixture containing lime.

(*b*) *Seed and Manure in 7 in. Rows.* — Three experiments are averaged giving :—

	Average Field Germination: Plants per Area 10 ft. by 14 in.	Average Yield in Tons per Acre.
Super 1 cwt. plus Ephos 1 cwt.	28·8	21·6
Super 1 cwt. plus Ephos 1 cwt. plus carbonate of lime 1 cwt.	30·7	22·2
Difference	6 per cent.	0·6

The differences in germination and yield are comparatively small. Only one experiment—super plus Ephos plus lime—was significantly better in yield than super plus Ephos.

2. Time of mixing Super and Lime prior to Sowing.

Table 1 shows the average field germination and yield in four experiments carried out to investigate the effect of varying the proportions of super to lime, and the time between mixing the super and carbonate of lime and sowing the crop. Super 2 cwt. without lime is included as a comparison with the other treatments. Three experiments were sown in 14 in. rows and one in 7 in. rows.

Table 1.

Treatment per Acre.	Time of Mixing.	Average Field Germination: Number of Plants per Area 10 ft. by 14 in.	Average Yield in Tons per Acre.
Super 2 cwt.		11·3	9·1
Super 2 cwt. plus lime 1 cwt.	Immediately before sowing	16·3	11·8
Super 2 cwt. plus lime 2 cwt.		19·4	13·0
Super 2 cwt. plus lime 1 cwt.	One day before sowing	17·2	11·5
Super 2 cwt. plus lime 2 cwt.		19·1	13·3
Super 2 cwt. plus lime 1 cwt.	One week before sowing	18·5	12·0
Super 2 cwt. plus lime 2 cwt.		21·4	13·4

The germination and yields are considerably better on all plots receiving the mixture of lime and super than on those receiving super alone. Using two parts of super to one part of lime has not reduced germination injury nor increased yield to the same extent as the mixture containing equal parts of super and lime.

Varying the time between mixing the super and lime and sowing has caused comparatively little difference in germination and yield. The practice which some farmers adopt of mixing in the field immediately before sowing would appear to give quite good results, only a little inferior to those from a mixture made a week before sowing. Mixing at least a week before sowing is recommended if facilities are available for doing this. Time will be saved during sowing, although it must be understood that mixed material should not be bagged until it has been left in a heap for a day or two, after which it should be turned with a shovel. The mixture will set slightly, but is easily broken up, after which it will not set again.

(To be concluded.)

Summer Control of Red-mite in Orchards.—In the 1930 season summer spraying with various oils was carried out with good results for the control of red-mite, in some plots 95 per cent. control of the pest being secured. Some of these trees form part of a black-spot spraying experiment this season, in conjunction with others that did not receive the summer oil treatment. The difference in appearance of the trees which received the summer oil treatment and the others is remarkable. The former have remained practically free from red-mite infection, while the latter show a very perceptible infection, though all have received the same treatment this year. It would appear from these experiments that it is more beneficial to successfully control red-mite during the growing season than allow the pest to accumulate during the late summer and carry over a heavy infestation of eggs, and endeavour to destroy them by heavy applications of oil in winter or spring.—*J. H. Thorp, Orchard Instructor, Nelson.*

BOYS' AND GIRLS' AGRICULTURAL CLUBS.

RECORD OF ACTIVITIES IN 1930–31 SEASON.

Fields Division, Department of Agriculture.

Boys' and girls' agricultural club activities throughout the Dominion for the season 1930–31 were characterized generally by success and expansion. In all districts in which clubs existed previously there was an increase in the total entries finally judged. In two districts—Hawke's Bay and Canterbury—clubs were inaugurated on a fairly extensive scale and with considerable success, even though the amount of attention given the new clubs was somewhat restricted on account of the limited funds available.

(1) Wellington, Taranaki, and Hawke's Bay Area.

Though agricultural clubs have been operating in the Wellington-Taranaki area for many years, the movement is not at all stabilized and important changes are taking place. In Taranaki, for instance, there has been a substantial decline in the crop competitions. Of the factors operating to bring about this result the main are probably (1) the increased claims to attention of the calf clubs, (2) the falling in relative importance of special crops in Taranaki farming, because of the greater attention given to ensilage, and (3) the weakening of interest that naturally is likely to occur in a movement which has lost all traces of novelty because of its long-continued existence.

The crop competition entries also declined to a fairly substantial extent in the Wanganui - Main Trunk districts, and to a slight extent in the Wairarapa. On the other hand, there was an increase in the Manawatu, while crop competitions were conducted for the first season in Southern Hawke's Bay, where on account of restricted funds a limit was set at the beginning to the number of entries that would be accepted. The additional entries in Manawatu and Hawke's Bay were not sufficient to offset completely the decline in other districts, so that the total completed entries for the whole area numbered 657, compared with 742 in 1929 and 847 in 1928.

The advance in popularity of the calf clubs much more than counterbalances the decline in crop competition activities. The good support previously given the calf clubs in Taranaki was maintained, and, in addition, calf clubs were introduced in the Manawatu, Southern Hawke's Bay, Horowhenua, and Wairarapa districts. In Horowhenua, because of restricted funds, the calf club organization received no financial assistance from official sources. Nevertheless its activities were characterized by efficiency and success.

Generally, the calf-club movement has quickly won popular support and appreciation, and the co-operation readily accorded by prominent breeders and progressive farmers generally augurs well for the continued success and expansion of the movement. The number of calves judged

in the Wellington-Taranaki area according to districts during the past two seasons is as follows :—

	1929–30.	1930–31.
North Taranaki	291	251
South Taranaki	360	403
Manawatu	..	187
Hawke's Bay	..	65
Wairarapa	..	43
Horowhenua	..	55
	651	1,054

The completed entries in the crop competitions in the same area were :—

	1929–30.	1930–31.
North Taranaki	131	66
South Taranaki	118	101
Wanganui - Main Trunk	221	177
Manawatu	179	211
Wairarapa	76	69
Southern Hawke's Bay	..	33
Ohura	17	..
	742	657

Crop Competitions.

In North Taranaki the crop competitions were carried on as previously with mangels and swedes, variety trials which were incorporated in the competitive work adding materially to the interest aroused. The varieties of mangels grown were Prizewinner Yellow Globe, which averaged 55·4 tons per acre, and White Sugar, which averaged 49·9 tons—a result which confirms previous experience indicating that, in yield, Prizewinner Yellow Globe excels in North Taranaki trials. The mangel championship was won by Douglas Strong, Tataraimaka School, with a crop of 128·5 tons per acre.

The swede varieties grown were Vilmorin's White-fleshed Purple-top, which averaged 35·9 tons per acre; Superlative, 31·4 tons; and Herning, 29·9 tons. The swede championship was won by Connie Stapleton, of Egmont Village, with a crop of 49·6 tons per acre.

In South Taranaki carrots and mangels were grown. The mangel yield averaged 52·45 tons per acre, a decrease of over 6 tons per acre in comparison with the previous season, this being due partly to unfavourable weather conditions. The variety yields were: Prizewinner Yellow Globe, 58·8 tons; White Sugar, 46·1 tons. The champion crop was that of Will. Laursen, with 98·45 tons per acre.

In carrots the average yield was 45·15 tons, an increase of nearly 10 tons per acre over the previous season. The variety yields were: Matchless White, 43·95 tons; Guerande, 46·35 tons per acre. The champion crop was that of John Cook, Huinga, with 75·85 tons per acre.

In the Manawatu-Oroua district mangels and maize were grown. The mangel crop, Prizewinner Yellow Globe, averaged 45·2 tons per acre, a decrease of over 5 tons per acre in comparison with the previous season, due primarily to the unfavourable conditions. The champion crop was that of E. Thompson, Kopane, with 122·3 tons per acre.

The maize class was included in the competition for the express purpose of trying out quick-maturing varieties recently introduced to

the district from America in the hope that they would prove suitable for grain-production for pig-feeding. The crops were disappointing, being damaged by early frosts. The average yield was 23·4 bushels per acre. The champion crop was that of D. Christensen, Oroua Downs, with 45 bushels per acre.

In the Wairarapa Prizewinner Yellow Globe mangels were grown. The average yield was 48·1 tons per acre, this being 10 tons per acre greater than that of the previous year. The champion crop was that of Quentin McGovern, Mauriceville, with 98·5 tons.

In Southern Hawke's Bay, holding crop competitions for the first season, Prizewinner Yellow Globe was grown and averaged 40·5 tons per acre. The champion crop was that of Winifred Skinner, Woodville, with 79·35 tons per acre.

Calf Competitions.

In both North and South Taranaki calf competitions are not only well established but continue to grow in popularity. The competitions were in general carried out along the lines of previous years. The competition caters for both pedigree and grade animals in separate classes, and distinct competitions for (*a*) dairy type and (*b*) condition are scheduled. As previously, the interest and assistance of supervisors, parents, and teachers have been a feature of the competitions and have contributed materially to their continued success.

Championship winners are given in the following table :—

Class.	Competition.	Winner.
	North Taranaki.	
Jersey-Ayrshire ..	Condition ..	T. Stockman (champion), Oaonui School
,, ..	Type ..	Bill Mullan (champion), Bell Block School.
Shorthorn-Friesian ..	Condition ..	J. Tebbutt (champion), Egmont Village School.
,, ..	Type ..	Jean Tebbutt (champion), Egmont Village School.
Pedigree Jersey ..	Condition ..	Rupert Loveridge (champion), Tariki School.
,, ..	Type ..	N. Sampson (champion), Hillsborough School.
Pedigree Ayrshire ..	Condition ..	Richard Philp (champion), Fitzroy School.
,, ..	Type ..	Lindsay Weir (champion), Lower Mangorei School.
Pedigree Friesian ..	Condition ..	Venice Peters (champion), Kaimiro School.
,, ..	Type ..	Venice Peters (champion), Kaimiro School.
	South Taranaki.	
Jersey-Ayrshire ..	Condition ..	Vera Stallard, Bird Road.
,, ..	Type ..	Myra Wren, Tokoura.
Shorthorn-Friesian ..	Condition ..	Ivy Major, Toko.
		S. Stallard, Bird Road (equal).
,, ..	Type ..	L. Stallard, Bird Road.

In the remaining districts of the Wellington area calf clubs, being in their first season, were not so specialized in class as in Taranaki,

the competition being open only to grade calves for which the following classes generally were scheduled: (*a*) Dairy type, (*b*) evidence of good rearing. In general the calf-club work met with success and evoked a remarkable amount of interest, and this, together with most valuable assistance forthcoming from prominent breeders and officers of show associations, as well as from parents and teachers, augurs well for the continued success of the clubs. The principal results were as follows:—

Manawatu Championship.—Dairy type—C. Webb, Glen Oroua. Rearing—J. Clark, Kairanga.

Southern Hawke's Bay Championship.—Dairy type—C. Phillips, Te Rehunga. Rearing—C. Phillips, Te Rehunga.

Wairarapa.—(*a*) Pahiatua: Dairy type—E. Bryant, Ruawhata. Rearing—E. Bryant, Ruawhata.

(*b*) Carterton: Dairy type—R. Hawke, Clareville. Rearing—J. Edwards, Ponatahi.

The Henry Low and Co. challenge shield for the school doing the best club work was awarded to Egmont Village, as was also the Trimble Shield.

(2) Canterbury Area.

The clubs were first started in Canterbury in 1930. The number of plots inspected was as follows: Mangels, 120; potatoes, 646: total, 766. Of these, 700 reached the final judging stage.

In spite of the dry season yields were quite high, the average being—Potatoes, 10 tons an acre; mangels, 33 tons. The highest yields were—Potatoes, 27·5 tons an acre; mangels, 85 tons.

The work seems to have suffered because it was not characterized by the local interest and supervision which is so prominent in districts in which agricultural clubs are particularly successful.

(3) Otago and Southland Area.

Both crop and calf competitions were conducted with success on an extensive scale in Otago and Southland.

Otago.

Crop Competitions.—Though particular districts had conducted crop competitions in previous years in Otago, the season under review marks the first year's operation of the Boys' and Girls' Agricultural Clubs' Association, the executive of which advises that it has every reason to be satisfied with the work done. The crops grown were mangels and carrots.

In carrots there were eighty-four competitors from thirty-three schools. The average yield was 15·95 tons per acre, and the highest yield was 44·6 tons, secured by G. Prentice, Port Molyneux. The championships were won by J. Wilkinson, Teaneraki (Intermediate Division), and T. Landreth, Katea (Junior Division).

The following special awards were made:—

Most points in field-work: Intermediate—R. Newlands, Kauru Hill; Junior—T. Landreth, Katea.

Most points in record-keeping: Intermediate—J. Wilkinson, Teaneraki; Junior—T. Landreth, Katea.

In mangels thirty-eight entries came from twenty-one schools. The average yield was 34 tons per acre, and the highest yield 62 tons per acre secured by Mary Simpson, Maungatua. The mangel championships were won by James Rowlands, Teaneraki (Intermediate Division), and Ivan Smith, Palmerston South (Junior Division).

The following special awards were made :—

Most points in field work : Intermediate—O. Scahill, Windsor ; Junior—I. Smith, Palmerston South.

Most points in record-keeping : Intermediate—Hector McDonald, Lovell's Flat ; Junior—N. Lory, Awamoko.

The winner of Sutton's silver challenge cup, awarded for the highest aggregate points in crop-growing, was T. Landreth, Katea.

Calf Competitions.—The first year's results with calf competitions in Otago are extremely satisfactory, seventy-five entries having been judged. Awards are based on the condition and type of the calf, considered in conjunction with the records kept by the competitor. The championships awarded in 1930 were :—

Large breeds (Friesian and Shorthorn) : Brian Neale, Papakaio, with a Friesian.

Small breeds (Ayrshire and Jersey) : I. Ashworth, Galloway, with an Ayrshire.

SOUTHLAND.

Crop Competitions.—Successful competitions, involving a total of 227 completed entries, were conducted in connection with potato, chou moellier, mangel, and carrot crops. The crop championships were won as follows :—

Potatoes (variety King Edward) : Greer Miller, Gore.

Chou moellier (variety Green Stem) : Alex. Gerrard, Winton (Intermediate Division).

Mangels (variety Prizewinner Yellow Globe) : Bert. Hassid, Otautau (Junior Division).

Carrots (variety Red Intermediate) : Eric Middleton, Lora Gorge (Junior Division).

The following special awards were made :—

Potatoes : Most points in field-work—Dorothy Patterson, East Chatton School ; Annie Middleton, Lora Gorge ; Alex. Henderson, Kennington ; Alex. Weir, Gore. Best record chart—Greer Miller, Gore.

Chou moellier : Raymond Evans, Longbush.

Mangels : Bert Hassid, Otautau.

Carrots : Barbara Ness, East Chatton.

The following table summarizes the cropping results :—

Crop.	Average Yield per Acre.			Highest Yield per Acre.		
	Tons	cwts.	qrs.	Tons	cwts.	qrs.
Potatoes	15	4	2	27	0	3
Chou moellier	28	11	3	45	9	3
Mangels	23	5	2	50	10	3
Carrots	15	15	0	46	0	0

The crop varieties grown were : King Edward potato, Green Stem chou moellier, Prizewinner Yellow Globe mangel, and Red Intermediate carrot.

The following special trophies were awarded :—

Solid silver shield presented by the Southland council of the New Zealand Institute of Horticulture to the school gaining the highest average aggregate points in cultivation, management, and yield in the crop-growing competition : Lora Gorge School, 61·7 points (six competitors) ; also holder of the shield for the previous season with 59·2 points. Runner-up : East Chatton School, 61·5 points.

Silver shield presented by the Southland Provincial Farmers' Union to the school gaining the highest aggregate points over all phases of work in the crop-growing competition : East Chatton School, 87 points (seven competitors). Previous season's holders, Knapdale School, 85·6 points. Runner-up : Lora Gorge School, 86 points.

Calf Competitions.—The second year of calf clubs in Southland, when 120 entries were judged, was marked by a considerable advance in comparison with the initial year, when thirty-eight entries were received. The clubs are conducted in a similar manner to those of Otago described above. The 1930–31 championships were won by :—

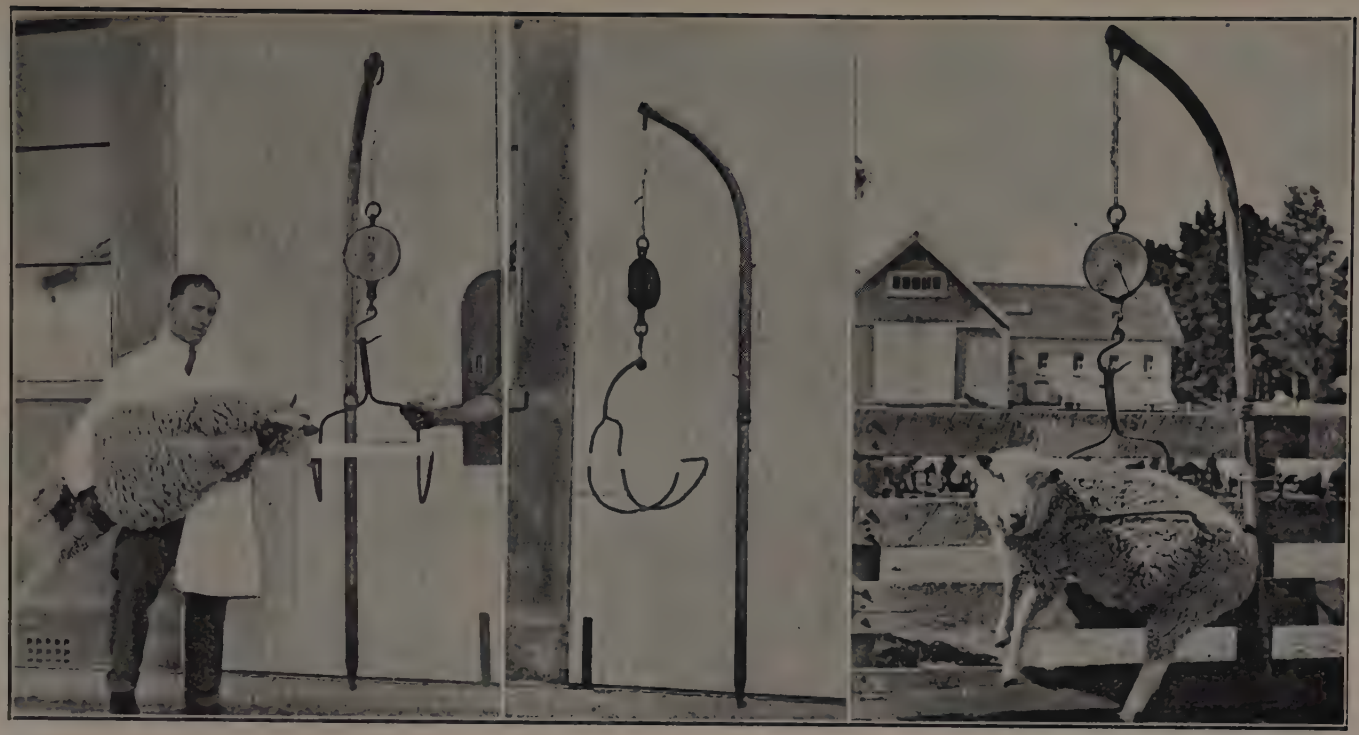
Large breeds : G. Mortimer, Makarewa (Friesian).
Small breeds : L. Hartley, Ryal Bush (Ayrshire).

A SIMPLE APPARATUS FOR WEIGHING SHEEP OR LAMBS.

D. J. Sidey, B.Ag., H.D.D., Canterbury Agricultural College, Lincoln.

The accompanying photographs illustrate a device which has been used at Canterbury Agricultural College for some years for the purpose of weighing experimental sheep, and which has proved both satisfactory and convenient. While a weighbridge may be the most efficient method, it has the disadvantage of high initial cost, and the fact that it cannot be transferred easily from place to place makes its use unsatisfactory for the field experimental worker. The object of these notes is to make this simple and relatively cheap method of weighing sheep widely known to experimental workers, farmers, and fat-lamb buyers.

The apparatus, which can be made in any iron workshop, consists of an upright arm bent at the top to support a spring balance and the sling used for holding the sheep. The most satisfactory arm has proved to be an 8 ft. length of 1½ in. galvanized-iron piping, one end of which is drawn out to a point to penetrate the ground and about a foot length of the top bent over in a gradual curve. A hole is then bored through the pipe at the top end to take a U-shaped shackle (made out of ½-in.-round iron) to which the balance is attached by means of a piece of light rope. In order to facilitate carrying the pipe it has been cut in half and the two halves reconnected by means of a collar, so that they can be unscrewed to fit inside a motor-car. When set up in the sheep-yards the point of the pipe is driven into the ground on the outside of the yard beside a post, and a short piece of rope or wire is used to tie the pipe to the post. If a length of suitable pipe is not



THE WEIGHING APPARATUS AT CANTERBURY AGRICULTURAL COLLEGE.

Left—Front view, showing method of grasping sheep before placing it on sling (the sling is here higher than it would be in practice, owing to the bottom of the pipe being on a raised ridge and not driven into the ground). Centre—Side view of the apparatus (the dark lines on scale in this and the left-hand view represent 3 in. spacings). Right—A sheep in the sling (in actual practice the pipe would be on the other side of the fence).

available a similar device can be made out of 3 in. by 2 in. timber, provided with a cross-arm at the top suitably braced to stand the strain.

A tested spring-balance is used for measuring the weight of the sheep, since it combines ease of reading, stability of the sling, and sufficient accuracy of the weights. While a steel-yard might be used, the fact that some sheep which are unused to the sling may be inclined to struggle, with the result that they may damage the knife-edges and also tip up the sling and thus jump out, makes its general use undesirable.

The sling is made of about 9 ft. of ½-in.-round iron, and the size and shape shown in the photos has proved to be most satisfactory for weighing mixed classes of sheep, but if full-grown animals are to be weighed it might be made a little larger. The bending of the iron is best done at dull red heat although if the iron is sound it could be bent cold, except at the point where the two ends of iron are welded together and bent to form a hole through which to pass the hook of the balance. The sling is about 15 in. long, 14 in. wide, and the curved part is about 10 in. deep.

In the photographs, for the sake of clearness, the sling is shown uncovered, but in actual practice the iron which comes in contact with the sheep is covered with old horse-cover felt to minimize bruising. A sugar-bag is then drawn over the framework to cover all the space between the bars, in order that the legs of the sheep will not slip down between them.

While one man can weigh sheep without a great deal of trouble with this apparatus, he is rather handicapped by having to pick up and put down pencil and note-book. It has been found that three workers give the most efficient results; one man to catch the sheep and place them on the sling; another to read the ear-tag or other numbering device and then to tip the sheep off; and a third to read the weight and record it and the number in a note-book. This gives a continuity to the work, and by exchanging positions to obviate one man doing all the lifting 125 or more sheep should be weighed in an hour.

The most convenient method of placing a sheep in the sling is to stand on the left hand side of the animal, place the left hand under the brisket, grasp the upper portion of the right front leg, and lift the fore end of the sheep off the ground. Then pass the right arm over the back of the sheep, under the stomach and grasp the left hind leg in the region of the stifle. A man of average build should then be able to pick up a sheep weighing up to 120 lb. live-weight, with both pairs of legs stretched out so that the sheep can be placed on the sling with the legs hanging clear. If this latter is not done the sheep are inclined to struggle and to jump off. With sheep over 120 lb. live-weight it may be found advisable to have one man to lift the fore end and another to lift the hind end, thus lightening the work.

The rope used to tie the balance to the shackle in the end of the pipe should be adjusted to such a length that when the sheep is in the sling the legs are just clear of the ground. If the rear end of the sling is raised slightly when the weight and number have been noted the sheep will slide forward, and can run out of the pen if the apparatus has been erected near a gateway.

The writer makes no claim to be the originator of the ideas on which the apparatus is built up; in its present form it represents the work of several people, in particular Mr. M. J. Scott and Mr. D. A. Campbell.

EFFECTS OF THE NOVEMBER FROST IN OTAGO ORCHARDS.

THE abnormal "freeze" which caused considerable damage in orchards in some parts of the Otago District on the morning of 25th November last had some peculiarities not usually associated with the ordinary frost visitation.

During the preceding day the thermometer was down around freezing-point, with frequent rain and hail showers until late at night. Freezing-point was reached at 2 a.m., and by daylight 8 or 9 degrees of frost was recorded. Apples were just past the fruit-set stage, and cherries were about the size of peas. An appreciable breeze was blowing, which prevented the smoke and heat from fire-pots rising more than a few feet. After daylight, clusters of cherries on the tops of trees were frozen together with ice formed from the rain on the trees when freezing commenced, but although the fruit was brown and shrivelled for a day or two it subsequently developed in the normal manner, with practically no reduction in the weight of crop.

Apricots were in full growth, and young shoots were defoliated and killed in many instances for the greater part of their length. The flesh of exposed fruit remained apparently firm or slightly shrunken externally, but internally was of a sponge-like texture with large open cavities.

Apples suffered severely, many orchards having not a single sound fruit left. Spurs which were carrying fruit turned brownish-black and waterlogged internally, only the centre of the wood remaining unaffected. The staining was general under the bark of the main limbs, and appeared likely to cause permanent injury. At time of writing, although the discoloration is evident, growth is coming away well from the old spurs, and the trees do not appear to be inconvenienced. Soft young shoots ceased growing for six weeks, the period of check being plainly shown by the short internodes and clustered disposition of the eyes, similar to the base of autumn second growth. It is remarkable that on these shoots podosphæra (powdery mildew) was general from the time of the check, while growths breaking from an old base since that date remain clean. In Cox's Orange only, mildew-infected foliage dropped almost immediately.

Pear wood proved less susceptible than apple, for whereas young growth from this season's grafts apparently softer than apple was not affected, growth on established neighbouring apples was cut back several inches. The general effect is that of a comprehensive summer pruning, and a heavy crop of laterals will be formed on this year's growth. Hard spurs have burst into growth, giving rise to some apprehension regarding next season's crop; but on present indications I consider that the elongation will not be excessive, and that fruit will be produced in sufficient quantities on the terminal buds.

—*G. H. McIndoe, Orchard Instructor, Dunedin.*

Correction.—Referring to the lists of select grape-vines imported, published on page 59 of the *Journal* for January last, the vines specified as received in exchange were from the Victorian Department of Agriculture, not from the South Australian Department as printed.

SEASONAL NOTES.

THE FARM.

Importance of Pasture Top-dressing.

DUE consideration having been given to the present general reduction in farm income, which makes it necessary to keep down expenditure as much as practicable, it may be said definitely that the wisest course in respect to our grasslands lies in the adoption for the coming few months of a top-dressing programme greater than has at any time been carried out in the past. The available evidence indicates not only that top-dressing may be employed generally to improve the farm position, but also that if it is not so employed the position on many farms will not remain stationary but will become appreciably worse.

In every extensive farming community there exists a section which was able to carry on in the past without resorting to top-dressing. In the changed present times a section which can carry on without top-dressing still exists, but in general it has become smaller. Some who have farmed, with satisfaction to themselves, with little or no top-dressing in the past, may attribute this mainly to one or both of two facts: Firstly, they were possibly working under exceptionally favourable circumstances, such as unusually low initial cost of land. Secondly, they certainly were gradually depleting their capital in that they were drawing off some of the original fertility of the land without taking any proper steps to replenish it. Their profits often would have been greater from the assistance of top-dressing, which now at times is essential if there are to be any profits at all.

These statements relative to the value of top-dressing are subject to two qualifications: Firstly, there are grassland areas for which top-dressing is not recommended. These, however, are exceptional, and any farmer should make sure that his own is one of the exceptional cases before he decides to carry on without the substantial assistance usually available from top-dressing. Secondly, the financial benefits to which reference has been made presuppose judicious expenditure on top-dressing. If top-dressing is not carried out wisely and linked up soundly with other aspects of pasture management, it may result not only in disappointing returns, but also at times in positive harm to pastures. Fortunately in New Zealand the main requirements of the top-dressing position are not so hidden as they seem to be in some other countries.

Phosphatic Top-dressing.

In general, the supply of available phosphate is the weakest link in the chain of crop requirements. Until this chain is strengthened in its weakest link production is unduly depressed. The deficiency of phosphates, though not universal, is very general in New Zealand soils; hence, as a rule, the primary consideration is the supply of phosphates. Until this has been placed in a satisfactory position it is seldom advisable to supply other top-dressing material. An occasional exception to this rule arises in respect to lime: sometimes phosphatic fertilizers will not function satisfactorily unless linked with liming. But as a general rule the first consideration should be phosphates.

Of the phosphatic manures superphosphate is most largely used. Field experience quite justifies this. Super as a rule excels all other phosphatic manures in localities of low rainfall, and in districts of high rainfall it will

generally at least hold its own with other phosphatic manures. It makes its influence felt more quickly than other phosphates. It is not nearly so temporary in its beneficial effect as some profess to believe; in carefully observed instances superphosphate has been functioning quite appreciably at twelve months and more after its application. Despite past teaching to the contrary, it is now definitely established that superphosphate does not cause any permanent sourness of the soil. To sum up, it may be said that super can be used over wide areas with the maximum of satisfaction—quick returns, high response, and reasonably long effect.

Next in importance to superphosphate, and of considerable moment, is basic slag. In the past on many farms splendid results have been obtained from the use of slag. In such cases it would be unwise to depart from its use, except on an experimental scale, until evidence had been obtained of superior returns from the top-dressing material with which it is intended to replace the slag.

In districts of good rainfall, African and similar phosphates may be expected to give good results, but, because of the comparative slowness of their action, they should not be used alone when an early response from the top-dressing is desired. Over wide areas a mixture of equal weights of one of these phosphates and of 44-per-cent. superphosphate is likely to produce good results on pastures.

It is not at all satisfactory to give general advice relative to the per-acre amount of phosphates that should be applied, for this depends upon many circumstances, including soil, climate, and financial resources, but some guidance is obtainable from the following facts: (1) Very satisfactory results have been obtained over wide areas from dressings of 3 cwt. an acre; (2) there are few, if any, recorded cases of phosphates being used in such excessive amounts as to be unprofitable on land which is known to respond to moderate dressings (say, 1 cwt. to 3 cwt. an acre); (3) generally, as experience of the results of top-dressing increases, the normal tendency is towards an increase in the size of the annual dressing of phosphates.

The Place of Potash and Nitrogen.

In certain districts, as, for example, in parts of Southland and Taranaki, official trials have given indication of definite responses from the use of potash on grassland. In districts in which such responses are being obtained farmers are justified in making fairly extensive trial use of potash. The use of potash should be linked with the use of phosphates, for the evidence points to a double deficiency in the soils of the districts concerned, and if this is not remedied the use of potash alone will be found unsatisfactory. Apart from the particular districts in which responses to potash have been noted in official trials, there is no evidence to justify recommending the use of potash in top-dressing generally. The material known as "30-per-cent. potash salts" is ordinarily the most economical source of potash for grassland.

In connection with dairying, autumn top-dressing of nitrogenous manures calls for brief mention. In those cases in which a shortage of winter feed is in prospect the use of soluble nitrogenous manure, such as sulphate of ammonia or nitrate of soda, in late March or April, at the rate of about 1 cwt. an acre, may be a useful emergency measure to increase the winter feed-supply. The use of such nitrogenous manures is satisfactory as a rule only in conjunction with the use of phosphates, which should be applied shortly prior to or at the same time as the nitrogenous dressing. Best results may be obtained from nitrogenous manures employed in the way just suggested by using them on fields which are well drained and which carry a sward rich in rye-grass.

Liming.

The matter of the liming of pastures is one about which advice is often given without any evidence to support that advice. The orthodox view of former times that liming is practically always economically sound cannot now be accepted. In New Zealand liming of grassland has produced very diverse results. Sometimes liming is obviously advisable; at other times it gives no apparent result. In view of this, expenditure on liming should not be incurred without evidence of success attending its use under circumstances similar in essential respects. Liming by itself is seldom financially attractive. It is as a rule unwise to resort to lime as a substitute for those more costly artificial fertilizers, such as superphosphate and basic slag, the worth of which has already been proved. However, if these latter manures are not giving satisfactory results the use of lime in conjunction with them is well worth a trial. The point probably of major current importance is that liming, as a cheap alternative to other top-dressing of proved value is, as a rule, false economy. It has already been remarked that liming is sometimes obviously advisable; when this is so, liming of course should be continued according to financial ability.

Autumn Management of Grassland.

Wherever pastures are known to respond satisfactorily, a special endeavour should be made to top-dress newly established grass. Sometimes young pastures deteriorate appreciably because of a slight initial lack of fertility, and it is usually more profitable to prevent early deterioration by means of suitable top-dressing than later on to renovate the swards which have suffered because of failure to top-dress in the early stages.

Generally autumn harrowing of pastures is very desirable. Whereas on new and vigorous swards the main purpose of the harrowing may be the thorough distribution of droppings, on the other hand, in the case of old matted swards in particular, it may be very desirable to secure sufficient penetration of the harrows to tear and aerate the turf. Both effects are so valuable that harrowing is now considered an essential link in the chain of practices constituting good pasture-management.

Winter and Spring Feed Measures.

The recent needed and general rains have brought a welcome change in the colour and growth of pastures over wide areas. In regard to feed for the coming winter and following spring, because of this change some farmers seem likely to become possessed of an unfounded feeling of security. The point of practical importance is that the changed appearance of the pastures is apt to be deceptive as to its effects on winter and spring feeding. While the extra growth that the recent rains ensure will be most valuable as a means of keeping up the condition of the stock prior to the difficult late winter and early spring period, it is desirable to bear in mind, firstly, that many farmers are facing the period mentioned with unusually low reserves of feed; secondly, that partly because of the possibility of early cold conditions, the growth of grass is not likely to be so substantial as current appearances would lead one to expect; and, thirdly, that, in any case, the growth is likely to be of a lush, immature nature, lacking the value for winter feeding that characterizes the more mature growth frequently available for winter.

These considerations indicate that much reliance cannot safely be placed upon the results from the recent rains, but that cropping measures suited to strengthen the feed position should generally be pushed on as much as possible. The most important step that may yet be taken in this connection is probably the sowing of cereals. If relatively early feed is definitely desired, barley or white oats should be employed, but in districts

where such oats suffer severely from rust they should be employed only if it is intended to use them simply as a catch-crop for green feed, and not to let them develop eventually into a grain or chaff crop. When early feed is not specially desired, Algerian oats—which rightly are popular for green feed—may well be used; they can be fed off and then used to produce good chaff.

Oats for winter and spring feed and subsequent grain or chaff production should, if possible, be sown not later than April or early May, and it will usually prove profitable to fertilize them with 1 cwt. to 2 cwt. per acre of superphosphate, while if the crop is to be grown on land exhausted appreciably by previous cropping it may be advisable to use ammoniated superphosphate, so as to correct to some extent the shortage of nitrogen.

For the purpose of building up the maximum possible supplies of winter feed care should be taken to turn into silage or hay, before frost injury has occurred, any available green maize or millet. Silage should be made in preference to hay if the green material available is not so small as to lead to undue wastage in ensilage.

Swedes attacked to any considerable extent by dry-rot should be fed without any avoidable delay. In using cereals for green feed better results are usually obtained by feeding off two or three times when the growth is not very tall, instead of waiting until there is a tall growth which not only is apt to involve relatively heavy wastage by trampling, but may lead to a poor second growth.

Seasonal Work with Lucerne.

Autumn work with lucerne is at times of importance. Occasionally the growth made during the latter part of the season is grazed. The trampling thereby incurred definitely favours the entrance of grass, hence such grazing is usually inadvisable in the interests of the lucerne. This is especially true of districts of good rainfall, in which grass may become such a strong competitor with lucerne as to become one of the worst weeds affecting it.

A lucerne area that has become infested with weeds often may with advantage be cultivated in April. The implement used for this purpose should be fitted with narrow tines to avoid as much as possible mutilation of the lucerne plants. Because of the mutilation it is likely to cause, disking is nearly always definitely inadvisable. Cultivation carried out so late as to exclude the possibility of any further considerable growth of the lucerne in the current season may frequently be followed with advantage by an immediate sowing of 1 bushel to the acre of Algerian oats. The oats not only check the development during winter of more permanent plants which would prove serious weeds of lucerne, but also give with the lucerne in the spring a heavy growth of well-balanced feed. It is highly desirable that plans should be made to utilize the spring growth of oats and lucerne for ensilage early in the season, for if it is left standing past the time when early ensilage is possible the oats may shade the lucerne to its definite detriment.

The Cereal Crops.

In the autumn much important work with cereal crops demands attention. In past March issues of this *Journal* considerable reference has been made to such matters as manuring and disease-control relative to cereals. During late years our knowledge relative to such matters has been added to substantially, and information as to the most effective practices may be obtained on application to local officers of the Fields Division.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Disease-control.

ALTHOUGH it may be considered that the main summer spraying programme is now about closed, in many orchards it is unsafe to say that it is completed. Where red-mite has not been effectively controlled, the application of an oil spray will materially assist in reducing the numbers of the pest to be fought next season. The prevention of "pin-point" spot must not be neglected, for with dewy nights this form of black-spot is quite liable to ruin an apple or pear crop and thus nullify all the previous work of the season. Lime-sulphur will act as an efficient protectant.

Where hygienic measures have not been applied during the season in assisting the control of brown-rot, much can still be done to reduce infection for next season. All affected twigs should be cut back into healthy wood, diseased and mummified fruit picked up from the ground and from off the trees, and the whole destroyed by burning. If this work is done now the diseased wood will be much more easily distinguished than if left until pruning-time. The need for these precautions will be appreciated when it is known that the new infection for the coming season comes largely from the affected twigs and mummied fruits.

Cultivation, Irrigation, and Cover-crops.

Those growers intending to grow cover-crops this autumn should not delay, if a good stand is to be obtained before the winter sets in. Cultivation, except for cover-crops, will now cease; but irrigation should continue late into the autumn to ensure a moist, but not wet, condition of the soil.

New Plantings and Replacements.

If it is intended to add to acreage growers must now make up their minds as to the numbers of each variety they intend to plant, so that orders may be immediately placed with nurserymen in order to avoid disappointment. When ordering, make a stipulation that only the variety asked for and on the required stock shall be supplied. Ask that you be notified immediately if the nurseryman cannot supply you with any of the trees ordered, at the same time advising you of any other varieties he may have in stock that might fill your requirements. This will give time to make a fresh selection or to try elsewhere.

In considering additions, replacements, or workings over, consider well what varieties or classes of fruit you will obtain. The work of the picking season must be considered so that it can be reasonably well spread out; the filling of a gap, especially in stone fruits, between one variety and another is very desirable, so that your fruit may be before the public for as long a period as possible. The suitability of the variety to local conditions and to market requirements must also be seriously considered before ordering.

There is also the question of replacements. Trees may be seen that have not been profitable for years, and it is difficult to conceive how they have been allowed to encumber the ground for so long. They should be rooted out and replaced by more profitable trees. In some of the older orchards varieties are somewhat mixed, which makes almost every operation in the orchard difficult. In replacing these, endeavour to gradually eliminate the old trees by planting to a system that will gradually give a block of one variety. Much can be done in this way to ease the general work of the orchard.

Miscellaneous.

Export work will now be at its height, and only if attention is given to the details mentioned in last issue can a successful pack be expected.

The points suggested are equally important for the grower who intends to place his fruit in home or cool storage for supplying the markets during the winter and spring months.

Buds recently inserted should be examined, and if the leaf-stalk easily falls away when touched one may be assured that they have "taken"; but if the stalk persists and there is evidence of a shrinking of the buds, two or three weeks after the insertion, they will almost certainly have missed. Where it is considered that the bud will not survive, it is worth while to take the risk of the lateness of the season and immediately insert another, if possible below the previous working. Bands which have not been cut should be watched, and any tendency for them to cut into the stock avoided by cutting the tie as previously advised.

—W. R. Lloyd Williams, Orchard Instructor, Alexandra.

Citrus Culture.

Cover-crops: The recent rains will have put the soil into good condition for the sowing of green crops for ploughing under later in the season. Those plants that produce the greatest amount of growth in the shortest possible time are the best for this purpose. In order to stimulate growth it is advisable to make the sowing of the seeds coincide with the application of some fertilizer, which should be applied during the autumn. Soils that are rich in organic matter cause the trees to grow more readily, and, moreover, in a measure help the trees to resist some of the diseases now so common. Green crops of various kinds, if grown each season, must eventually help to improve the mechanical condition of the soil. Quick-acting artificial fertilizers are useful, but they can never make up that deficiency which alone can be supplied by organic matter.

Where any working of the soil is carried out prior to the sowing of cover-crops, it should all be done with the view to making a slight slope away from the trees. There is nothing so injurious to the root-system of almost all fruit-trees as stagnant water. If care is exercised in the direction indicated losses will not take place through the land becoming waterlogged.

Brown-rot: The yearly loss from brown-rot is a serious matter, and varies in severity according to the rainfall. Preventive measures should be taken in the direction of cutting away any branches that touch the soil. In some quarters it has been found that treating the soil with a light dressing of sulphate of iron has a very beneficial effect in checking spore development. Although it is doubtful whether any complete remedy can be found if there is a long and continued period of damp and humid conditions, growers should be seized with the necessity for taking every reasonable care in regard to this disease. Possibly one of the principal factors is good sanitary conditions throughout the orchard.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Management of the Pullets.

If the pullets, particularly those hatched on the early side, are to succeed in their future function of producing winter eggs, it is of the first importance that they receive uniform care and attention in every respect. Otherwise the birds are almost sure to go into a premature moult, which means that the energy which should have been devoted to the production of eggs will go to the production of new feathers. All possible steps should be taken to discourage the birds from going into an early moult.

In the first place there should be no violent change in the system of handling and feeding. The birds should be placed in their winter quarters before their laying period commences. Further, they should not be suddenly placed on a heavy meat diet—in fact, there should be as little change in the diet as possible. Meat should be introduced gradually to the ration as the birds show indications of starting to lay. Where possible, the winter layer should at all times be fed under shelter and not be compelled to wait about in a cold wet yard for food. If winter eggs are to be secured in good numbers the floor must be well covered with straw litter so that the birds may exercise in comfort by being compelled to scratch for their grain ration during cold and wet weather.

As regards the quantity of food necessary for a given number of fowls, no definite rule can be laid down. The birds should be given as much as they will eat at each meal without waste. The good layer will not eat more than she requires if fed regularly, and will turn the food into eggs, while the poor layer will turn it into fat. A bird that has to be fed a reduced ration in order to prevent her from becoming too fat, while provided with ample means to exercise, should have no place in the run where heavy egg-production is the object. The good layer is generally active, and does not fatten as quickly as does the drone. An ample supply of animal food, such as meat or meat-meal, is necessary for promoting winter egg-production. The good layer will consume much more oyster-shell than the drone; hence in a heavy-laying flock there should be no stint of this or other sea-shell for an egg-shell forming, otherwise a high proportion of weak-shelled eggs will result.

Non-laying Ducks.

Several complaints have reached me of late regarding Indian Runner ducks going into a moult and not laying up to expectations. In some cases the owners have adopted the plan of changing the food, being under the impression that the food previously supplied was responsible for the birds moulting and their failure to lay. This, however, does not necessarily apply, as it is quite common for ducks, even when they receive proper food and management, to moult twice a year—about February and again in June or July.

Ducks that have been well fed and managed, and which have had a good egg-yield previous to moulting, should not have their ration changed, as this would only make matters worse. A bird will always come back to laying condition much quicker when there is no alteration in its treatment. The treatment being given may not be quite right, but any sudden change will not improve matters. Any contemplated change in the ration provided should be introduced by degrees. Ducks are usually of a very nervous temperament, and any alteration in the method under which they are kept will cause them to fret, thereby intensifying any unfavourable condition to which they have been subjected. That laying ducks require frequent changes of food is one of those theories which fails lamentably in practice.

Ducks are creatures of habit, and therefore a change of quarters will have an equally bad effect on the egg yield as a change of food. Fright caused by the presence of hedgehogs, ferrets, &c., will often upset ducks, and this will be followed by a false moult and failure to lay. The lights from motor-cars, &c., will also often have this undesirable effect. For this reason ducks should be kept as far away from the road as possible. Even then the house in which they are kept should be arranged in such a way that the lights from cars cannot shine brightly into it. It will usually be found that the greater the number of ducks kept in a flock the greater will be the risk of their frequently moulting and ceasing to lay when subjected to changes of food and quarters. It will thus be seen that if the laying duck is to produce eggs to its maximum capacity the matter of uniform treatment in every branch of its management is imperative.

Feeding and Breeding Considerations.

In view of the present high cost of food and the low prices ruling for eggs, many poultry-keepers are naturally looking for every means of economizing in the food bill. Unfortunately, many are inclined to economize in the wrong manner by using cheap substitutes for recognized good foodstuffs, or in not giving their fowls sufficient food, while they are also apt to lend a willing ear to the advice of neighbours and others who have some new idea for feeding poultry.

The most common fallacy in this direction is the foolish advice which is being so freely advocated that chickens cannot be successfully reared, and that adult stock cannot be maintained in a sound healthy state and produce a paying egg-yield, nor have the power to ward off disease, unless certain stimulants, tonics, chemicals, &c., are added to the ration provided. I am repeatedly being called upon, particularly by inexperienced poultry-keepers, for advice as to the value of one or other of these materials, but seldom are inquiries of this nature received from successful men in the business. These men realize that if stock are to be maintained in a vigorous healthy condition (and they can be profitable only if they are healthy) sound breeding, feeding, and general good management are the great underlying principles on which to work. They realize that pampered stock can never give a good account of themselves, and that if a high proportion of weakly stock is being produced the methods of breeding, feeding, and general management are not what they should be. In view of the fact that stock could be successfully reared and maintained in a healthy and high-producing condition many years ago without the aid of chemicals, &c., there is no reason why this should not be the case to-day, providing common-sense methods of management are resorted to.

It may be true that many strains of laying stock are manifesting signs of deterioration in size of body and constitutional vigour, and that as a result their progeny are difficult to rear, while even many that are brought to maturity rarely develop into highly profitable stock. The great underlying principle in breeding the modern layer is to see that no bird, whether male or female, is placed in the breeding-pen unless undoubted constitutional vigour is possessed. But this is not enough; the progeny must be given every opportunity of securing a liberal supply of natural food and be reared under natural conditions throughout the growing stage. Next in importance is the question of cleanliness. The houses must be maintained in an absolutely sanitary condition, while the yards must not be allowed to become stale and a breeding-ground for disease and parasitic life. A thoroughly clean run is just as important as a thoroughly clean house. In fact, cleanliness is essential in everything connected with poultry.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Autumn Operations.

By the time these notes are in print the month of March will be well advanced, and beekeepers will be fully occupied in doing the last of their honey-extracting and preparing their colonies for the winter. Should the autumn be mild, final extracting may be later than usual on account of a prolonged flow of nectar. Thistles will probably yield more nectar at this period than other plants, and will, when mixed with clover or catsear, produce a white, clear, and delicately flavoured honey which forms a splendid exporting article.

Should late extracting be necessary, great care must be taken to check robbing; an apiary may soon become demoralized if precautionary measures are not taken. When once robbing starts it may prove a difficult matter to stop. Thousands of bees may be killed by endeavouring to enter the wrong hives, and thereby the strength of the colonies be very much weakened; or the colonies may even be rendered incapable of going through the winter. When robbing has commenced, do not open any more hives until the trouble is controlled. This may be done by syringing the entrances of the offending hives with water, and in bad cases by placing wet grass over the entrances until the disturbance has been quelled. Do not on any account leave combs of honey open to attack, or keep a hive open an instant longer than necessary. If the colony attacked is weak contract the entrance in addition to the above-mentioned precautions. It may be necessary to suspend work in the apiary during the day, doing as much as is thought advisable in the early morning.

Foul-brood.

At all times of the year foul-brood is a menace to the beekeeping industry, and it is advisable to always keep a sharp lookout for any symptoms. This is especially the case during the spring and autumn months; and before pronouncing any colony fit for wintering the brood-nest should be carefully examined for the slightest sign of the disease. If a trace is discovered, or the disease is found in a more advanced state, judgment must be used as to the advisability of destroying the colony completely or of treating it.

Winter Stores.

As advised last month, do not fail to determine the quantity of stores available in the hives for winter consumption. A plentiful supply is sound economy, and my advice is that not less than 30 lb. of honey be left in each hive. There are occasions when late swarms have not gathered sufficient for their own wintering purposes, and then they must be fed either with clean healthy honey or with sugar syrup. Never use honey from an unknown source for this purpose.

Cleanliness and Order.

Before finally leaving the hives for winter it is a good plan to scrape the bottom-boards free of all the rubbish that has accumulated during the summer, thereby helping to keep the bees in a healthy condition. Also scrape the alighting-boards clean, and clear any long grass surrounding the hives; this will tend to keep away dampness. The hives should be placed on blocks several inches off the ground, and in a sheltered position where they may receive a considerable portion of the day's sunshine. Any leaky covers or split supers should be removed from the hives, and sound ones put in their place. Remember bees require dryness and warmth.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Bean-wilt Disease.

BEAN wilt was found last season attacking dwarf and runner French beans in the middle districts. Infected plants are now being sent in from many localities, with inquiries regarding the cause of the trouble and advice on treatment.

An article on this disease, which has been named *Phytomonas medicaginis*, appeared in the December number of this *Journal*. Some of the main facts which should be remembered are that it is caused by bacteria, parasitic vegetable organisms of microscopic dimensions—a class that is always

difficult to control when they attack crops. A specially insidious feature in the case of an attack by *P. medicaginis* is the fact that the symptoms are in no wise remarkable, for which reason many crops are found badly affected and the owner is quite unaware that a serious disease is present, the disfiguration usually being attributed to a recent storm, and the hope entertained that the crop will grow out of it. As one of the most important operations in control is to carefully burn infected material so soon as it is observed, the delay gives the disease every opportunity to spread through the crop, and even to be carried to others in the vicinity.

When attacking the leaves, the first symptoms to be noticed probably are the brown spots of various sizes and irregular shape that afterwards run together and become brittle, the progress usually being checked as the base of the leaf-stalk is reached. This condition is also common to other causes; but the reddish-brown lesions often found on the stems are more distinctive, and, like those on the leaves, make slow progress downwards; so that the base of the plant may be comparatively vigorous and sound, while the upper parts are more or less brown, shrivelled, and dry. Infected spots on the pods leave little doubt regarding identity; the isolated rounded water-soaked areas that afterwards become brown and dry are the most distinctive feature of this disease.

From this description it will be noticed that the bacteria do not spread through the tissues to any great extent, but the separate infections are numerous. These infections are caused by a thickish liquid which slowly oozes from infected areas; it becomes diluted and falls or is brushed on adjoining tissue, which may become infected even when the surface is unbroken. From this it is easy to understand how important it is to carefully pull and burn infected plants, or the traffic during cultivation and harvesting, especially on dewy mornings or after rain, will spread the disease rapidly through the crop—and even other crops of beans if they were visited while one had the bacteria in liquid suspension on hands or clothes.

An excellent method of burning such material was seen recently where a grower had a large 40-gallon oil drum with a few firebars fitted and an opening made for draught and lighting. The idea was to set it up in the middle of a cleared space in the infected crop, place a good bundle of inflammable twigs on the fire-bars for kindling, and then pack the drum carefully with the infected material. With a little adjustment, or delay perhaps, to allow the material to dry out to some extent, the diseased material is effectually destroyed without trailing the infection. In this way, by using the greatest care and avoiding that area when beans are being planted next season, the trouble may be controlled.

There is, however, a danger of introducing the disease again—as it was probably introduced before—by planting infected seed. Such seed may have pale yellow blotches on the surface, although all discoloured seed is not affected with this disease. Also in the case of coloured seed this stain may not be noticeable, or seeds lying beneath an infected area in the pod may be infected without showing stain or becoming shrivelled. All this makes it very difficult for the seedsman, for, however careful he may be, it is not possible to guarantee that a large area in crop is absolutely free from this disease. As there is no way of treating the seed effectually, the grower has to take this risk, and overcome it by using clean land and keeping a sharp lookout for any sign of trouble, and deal with it promptly if it should appear. If one has clean stock of good strain it should be maintained and guarded with the greatest care, for such stocks are already becoming rare.

Vegetable Crops.

The winter crops will now be coming to maturity. They include celery, leeks, cauliflower, broccoli, brussels sprouts, savoy cabbage, and

kale; and many root crops are ready to be harvested. As parsnips rather improve in frosty weather they are left in the ground until lifted as required. Autumn-sown carrots and beetroot also keep in best condition under this treatment in the warmer districts. Main-crop carrots require to be lifted, or they split and become woody and lose flavour.

The late potato crop should also be lifted and stored. In warm localities there is serious danger of the crop making a second growth if this operation is delayed. In such places the crop must be lifted promptly so soon as it reaches maturity. There are too many bad-flavoured and flavourless potatoes about, due to neglect in this respect. Crops should be lifted only in fine weather, and those dug should be graded and stored —or at least bagged up—before night. The crop should be carefully studied, and a proper estimation of its quality and condition so obtained. If it is good and sound the crop is worth storing for later use or consigning to the more distant markets. The pickers should be instructed and supervised in respect to sizing and the rejection of broken tubers. This opportunity is often missed, and good and bad, large and under-sized, are mixed together, to be sorted later at great expense and after the spores of disease have been well distributed through the stocks. All this expense and loss could be avoided by giving more attention at the first handling. If the quality of the crop is only fair and the condition variable, no attempt should be made at long storage. It is not worth the cost, and such a crop should be graded to best advantage and put to immediate use. Stocks of good quality and sound condition are suitable for long storage, but it must be of the right kind. Such conditions are clean, dark, humid, and cool storage, with little variation in temperature. Too often the first condition is lacking, owing to diseased and pest-infested rejects of past crops being left in the vicinity. An elementary knowledge of the life-histories of parasitic fungi and insects proves that reasonably clean habits are essential, especially where perishable produce is to be kept for comparatively long periods.

An important operation in most localities at this season is the planting of crops of cabbage and cauliflower for spring cutting. For these crops the land should be well drained and moderately well supplied with farm manure. Harrow in a good dressing of lime, and when a good tilth has been obtained mark out the rows and set the plants carefully, deep and firm. Light, shallow, hasty planting is quite a common cause for unsatisfactory crops. Another vain hope is to expect to get a good, even crop from a mixed lot of plants, when it can only be obtained by setting out plants carefully selected from the seed-bed.

As soon as the foliage on the asparagus crop ripens it is customary to cut it down to the surface of the ground and burn it. Then apply a dressing of partly decayed farm manure—as may be necessary to maintain the supply of humus—and plough it under.

Glasshouse Alterations and Repairs.

Now is the time to carry out any good resolutions made regarding such work. Many growers in the warmer areas will have made up their minds that more ventilation is required along the ridges of the houses, and now while the houses are empty is the time to carry out the work. Most houses in districts subject to occasional hot humid weather would benefit greatly by such an increased facility. An important feature in the construction of these ventilators is the hinges. As they are too inaccessible to be kept oiled, it is important they should be strong and not subject to corrosion.

To attend now to any necessary repairs in the way of painting or glazing may be taken as a matter of course, for once the water gets into the sash-bars and plates deterioration is very rapid. This is most likely to occur in the upright side-walls of a house, due to unsatisfactory construction

of the eaves, where the sash-bars of the roof are cut off short and nailed down on a flat top-plate which holds the storm-water, and allows it to filter down the wooden parts of the side-wall to rot the sill (which also generally has a flat top) and finally make the ground wet and cold for a couple of rows of plants nearest the side-walls in the house. Where this is the position it will generally pay to affix guttering in such a way that all the roof-water is collected and run into a tank, thus reducing depreciation and making at least a 10-per-cent. improvement in the crop. This may be done more easily before building by having the tops of plates and sills properly bevelled. If grooves are also made where necessary to prevent water soaking in beneath and keeping the underside wet, the life of the house will be greatly lengthened.

Planting Strawberries.

The planting of strawberries should now be done where the preparation of the land has been successfully accomplished. Obtain hardy, strong plants of a good strain of a variety suited to the locality. It is not sufficient to plant just strawberry-plants, even if they are big ones. It is important that they should be of a variety suited to local conditions. Not only that—for best results they should be of a good strain, for this plant, like other kinds after years of vegetative propagation, is apt to lose some of its most valuable characteristics and to deteriorate, unless careful selection is practised when propagating.

So soon as the plants arrive they must be unpacked, stood out in a single layer in a shady place, and watered, to cool and harden, as large quantities often become heated on a long journey.

If in the later stages of the preparation of the land a generous dressing of bonedust has been turned well under, an ounce or two of superphosphate per square yard, harrowed in a few days before planting, will be sufficient fertilizers at this stage under average conditions.

The land should then be smoothed out, marked, and planted. Here again the danger is in planting too high and lightly. In a friable soil the plants should be put in firmly with the top of the crown level with the surface of the land. Where the one-year cropping system is adopted, the spacing is usually 9 in. between plants and 27 in. between rows. Where three- or four-year cropping is practised these distances may be increased slightly. The land should be allowed to settle down and consolidate before planting.

The Homestead Garden.

In the descriptions of native trees suitable for the homestead garden that have been given in these notes recently nothing has been said about *Hedycarya arborea*. From the bush in Hawke's Bay a specimen bearing a handsome bunch of fruit was submitted recently for identification, and its very fine appearance proclaimed definitely that it is certainly worthy of consideration for planting in the homestead garden. It happens to be one of those small trees of about 20 ft. to 30 ft. high that are so useful about the homestead, but are quickly destroyed in the bush by browsing stock, so that they are rarely seen to advantage. In semi-shade, which suits the tree best, the orange-red, shapely fruit shows up very handsomely among the richly toned evergreen foliage. There are separate staminate and pistillate plants, the latter only, of course, bearing the fruit. The hardy porokaiwhiri, or pigeon-wood, has an unsuspected beauty when it is grown, as was the plant from which this specimen was taken, in natural bush from which browsing animals have been excluded.

Where planting is to be done the preparations should now be advanced as quickly as weather permits, as the short planting-season—that is, the season suitable especially for setting out hard-wooded plants—commences towards the end of May, and in most cases early planting gives by far the best results.

—*W. C. Hyde, Horticulturist, Wellington.*

WEATHER RECORDS: FEBRUARY, 1932.

Dominion Meteorological Office.

THE weather of February was remarkable for the complete break in the drought which had prevailed in many districts during the preceding months. During the second and third weeks two spells of heavy rain occurred. In the first, the area principally affected was in the eastern portion of the North Island from Cook Strait to East Cape, the falls being particularly heavy from Hawke's Bay northwards. The second rainy spell was between the 17th and 22nd. On this occasion the whole country benefited, heavy falls being practically universal, including Canterbury, Marlborough, and the Manawatu.

Rainfall.—The amount of rain for the Dominion as a whole must have approximated 50 per cent. above the average. In eastern districts between Oamaru and Timaru, from Wellington to East Cape, and about Auckland and the Coromandel Peninsula, many stations recorded more than double the average for February, and some three or four times that amount. Nevertheless, parts of the Auckland Peninsula, most of Taranaki, and parts of Southland and of the interior of Otago, had less than the normal.

Temperature.—In most places temperatures were below the normal for February, but in the interior the departures were seldom marked, and some inland parts of the North Island were warmer than usual.

Sunshine.—The amount of bright sunshine was much below average. Indeed, in many places it was the cloudiest February on record.

Storm Systems.—At the beginning of the month there was a continuance of the series of westerly depressions which had been passing rapidly across the Dominion. On the 7th, however, a tropical cyclone developed in the neighbourhood of Fiji. Moving southwards during the next few days it became very deep and extensive. This storm controlled the weather in New Zealand until the 15th. Rain commenced on the 7th or 8th, and from then on until the end of the period most of the North Island, except Taranaki and western Wellington, received good rains, with many heavy falls. The heaviest were from Cook Strait to East Cape, and especially from Hawke's Bay northwards. The 9th and 13th were the wettest days. A record flood occurred on the Poverty Bay flats on the 10th. During all this period south-easterly winds prevailed over the North Island, gales being reported at many stations. Towards the end the weather became cold.

The storm responsible for the above-mentioned rains had moved away eastward by the 15th. The weather remained sultry and humid, and everything was favourable for renewed rains should a disturbance develop. For some days, however, pressure variations were slight and rain was rather sporadic in character, thunderstorms occurring in many districts. On the 19th a cyclone moved from near Lord Howe Island just past the northern extremity of New Zealand, and its centre was east of Russell on the morning of the 20th. Strong north-north-easterly winds were caused all over New Zealand, and especially along the east coast. During the night of the 19th there were very heavy rains in North Otago and South Canterbury, and record floods occurred between Hampden and Timaru. The rain continued on the 20th, practically the whole Dominion, except parts of Otago and Southland, recording heavy falls. The number of totals on the 20th which exceeded 2 in. was remarkable. Many rivers were flooded in both Islands. The storm did not disappear from our weather charts until the 24th.

The month finished with another spell of westerly weather.

RAINFALL FOR FEBRUARY, 1932, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
	North Island.	Inches.		Inches.	Inches.
1	Kaitaia	2·28	7	0·84	3·59
2	Russell	4·40	7	1·82	2·78
3	Whangarei	1·99	8	1·08	4·00
4	Auckland	7·51	15	3·74	3·04
5	Hamilton	2·97	10	0·81	2·97
6	Rotorua	3·27	11	0·89	3·78
7	Kawhia	3·34	11	0·61	2·79
8	New Plymouth	3·04	12	1·23	3·87
9	Riversdale, Inglewood ..	4·06	10	1·15	6·14
10	Whangamomona	2·50	6	1·05	3·92
11	Eltham	3·92	11	1·81	3·21
12	Tairua	10·56	9	4·52	4·11
13	Tauranga	4·95	10	2·88	3·40
14	Maraehako Station, Opotiki	6·07	13	1·20	3·44
15	Gisborne	12·01	13	3·86	3·31
16	Taupo	3·23	10	1·49	2·79
17	Napier	6·20	18	1·48	2·81
18	Hastings	5·70	15	2·51	2·87
19	Taihape	3·62	11	1·71	2·24
20	Masterton	3·79	15	1·33	2·76
21	Patea	1·72	6	0·75	2·50
22	Wanganui	2·87	7	2·50	2·44
23	Foxton	3·25	8	2·50	2·11
24	Wellington	6·71	13	2·35	2·67
	South Island.				
25	Westport	8·03	17	1·97	5·35
26	Greymouth	6·71	12	1·78	6·10
27	Hokitika	9·68	12	2·13	7·22
28	Ross	11·95	9	3·55	8·85
29	Arthur's Pass	9·52	9	2·37	9·56
30	Okuru	18·16	13	8·08	8·72
31	Collingwood	5·52	9	1·42	5·24
32	Nelson	4·64	10	2·61	2·64
33	Spring Creek	3·39	10	2·40	2·22
35	Hanmer Springs	3·32	11	0·79	2·90
36	Highfield, Waiau	2·82	7	1·18	2·63
37	Gore Bay	5·15	8	2·07	2·76
38	Christchurch	2·95	8	1·34	1·73
39	Timaru	3·82	12	1·50	1·77
40	Lambrook Station, Fairlie ..	2·46	10	0·81	1·82
41	Benmore Station, Clearburn	1·80	10	0·90	1·33
42	Oamaru	4·35	13	1·30	1·73
43	Queenstown	1·23	12	0·36	1·95
44	Clyde	1·09	8	0·26	1·04
45	Dunedin..	4·30	14	1·08	2·74
46	Wendon..	4·27	8	1·20	2·04
47	Gore	..	..	..	2·65
48	Invercargill	3·75	17	0·85	2·99
49	Puysegur Point	4·25	16	0·72	5·76
50	Half-moon Bay	3·03	14	0·46	4·21

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith Letters should be addressed to the Editor.

TREATMENT FOR BLINDNESS IN SHEEP.

W. RICHARDS, Wairoa :—

I should be glad if you would give me some information regarding the treatment of blindness in sheep. Within the last two or three weeks I have noticed several cases in both lambs and older sheep. These cases have all occurred since the breaking of a long spell of dry weather followed by an unusually rapid growth of grass. The eyes of the sheep affected are covered with a white film, to disperse which I have tried an application of sugar but without satisfactory results.

The Live-stock Division :—

Blindness in sheep is not uncommonly met with at this season of the year. This condition, known as ophthalmia, has been shown to be transmissible from one animal to another by direct contact with the discharge of an affected eye. It is therefore advisable to isolate the affected animals and confine them in a level paddock without creeks or gullies in order to prevent them from injuring themselves. If any green feed is available, affected animals should be moved to such pasture. Green succulent young feed of this kind has effected recoveries without further treatment. At the same time, if only a small number of sheep are affected, the eyes should be bathed twice daily with a tepid boracic acid solution. If a large number are affected, the following lotion has been found very effective : 1 oz. of laudanum, 2 drachms of sulphate of zinc, with 1½ pints of pure water. The lotion may be instilled in the eye as the sheep pass through the race, a small sewing-machine oil-tin being found very useful for the purpose. A little pressure with the thumb on the bottom of the tin injects a few drops, and there is no waste.

PASTURE MIXTURE FOR HILLY CLAY SOIL IN HELENSVILLE DISTRICT.

R. B. WEST, Helensville :—

I have some 20 acres of fairly steep ploughable gum country, situated about three miles north of Helensville, that I wish to sow down in permanent pasture this autumn. The land is fairly heavy clay land facing the west, and thus liable to dry up fairly badly in the summer. Could you please tell me what would be a suitable grass mixture. We intend to sow with a little Algerian oats for winter feed.

The Fields Division :—

A suitable permanent-pasture mixture for a hilly clay soil in your district is as follows : Italian rye-grass, 5 lb. ; certified perennial rye-grass, 20 lb. ; paspalum 5 lb. ; crested dogstail, 3 lb. ; cocksfoot, 5 lb. ; red clover, 2 lb. ; white clover, 2 lb. ; Lotus major, 1 lb. : total, 43 lb. per acre. Perennial rye and white-clover seed sown should be certified seed. Paspalum should be Australian hand-shaken seed with a germination of not less than 35 per cent. The sowing of oats with permanent grass is not recommended on North Auckland clay soils, as the heavy stocking in early spring when feeding off the oats usually puddles the surface soil, which will then bake hard during dry summer weather. It would be best to sow oats in a separate piece of land.

TREATMENT FOR TAPEWORMS AND DISTEMPER IN DOGS.

"DISTEMPER," Gisborne :—

(1) Would you kindly tell me the way to rid sheep-dogs of worms. Does areca-nut if used more than once have a harmful effect on a dog's stomach ? (2) What treatment (practicable on a station) do you recommend for dogs suffering from distemper ? Is there any certain inoculation against it ?

The Live-stock Division :—

(1) Station dogs are liable to become infested with tapeworms from eating uncooked offal obtained when sheep are slaughtered for home consumption. The most common drug used on stations for the eradication of the tapeworms is powdered areca-nut ; the dose being gauged by using 2 grains per pound weight of the dog. It is advisable to buy the nuts and have the powder freshly ground before use. The dog is fasted for twenty-four hours before dosing. It is usual to give a dose of castor-oil or other laxative some hours after the powder. Areca-nut is not satisfactory for the eradication of round worms in young dogs, other drugs being used for this purpose. There is no evidence that areca-nut powder is harmful if repeated at intervals.

(2) The treatment of dogs suffering from distemper resolves itself into a treatment of the symptoms as they arise. Good nursing is one of the outstanding points, the animal being provided with a warm dry bed and clothing if necessary, at the same time being provided with fresh air (not draughts), and given easily digested nourishing food, such as beef-tea, &c. Certain drugs may be used to assist the nursing, but the latter must be very largely depended upon. The symptoms may be those of pneumonia, when nursing plays a prominent part. Again, gastric symptoms may be present, when milk food should be given accompanied by salol or other internal antiseptic. Jaundice may be in evidence, and nervous symptoms are quite commonly seen. Good nursing is the sheet anchor in treatment of affected cases. A preventive vaccine against distemper has been prepared in Britain, but has not been wholly satisfactory. The vaccine is being improved upon, and when proved reliable will be imported into New Zealand.

DESTROYING CONVOLVULUS IN VINERY.

"INQUIRER," Blenheim :—

I have a grape-house that is infected with convolvulus, and I have been nformed that it can be destroyed by dressing it with a 5-per-cent. solution of sodium chlorate. Would the sodium chlorate have an harmful effect on the vines ?

The Horticulture Division :—

A solution of sodium chlorate would destroy all vine roots it came into contact with. Under the circumstances it would be preferable to dig out the convolvulus roots with a fork as soon as the vine leaves have fallen. Any slight damage done to the vine roots while the vines are in a dormant condition will have very little or no detrimental effect on the future crops.

USE OF MEAT-MEAL IN CALF FEEDING.

G. T. HUTCHENS, Motu :—

Will you kindly give me information about feeding calves on meat-meal—the amount, and how long they have to be fed on new milk and new with half-skim, before the meat-meal feeding starts.

The Live-stock Division :—

The use of meat-meal for calves was primarily intended as a supplement to the food of calves being fed whey, but has also been used successfully with skim-milk-fed calves. The quantities of meat-meal used in the latter case are smaller than when whey is used. The calf is given whole milk for a period of nine days, after which skim-milk is added, the whole milk being gradually reduced until at twenty days of age the calf is receiving all skim-milk. Meat-meal is added on the tenth day (the first day of the skim-milk) at the rate of $\frac{1}{4}$ oz. per head per day, the amount being increased by $\frac{1}{4}$ oz. every two days, until at the twenty-sixth day the calf is receiving 2 oz. of meat-meal per day. The calves are fed twice daily, and a chart has been sent you giving the quantities in full detail. It is advisable to use a salt and lime mixture in conjunction with the meat-meal feeding. The mixture is prepared by mixing equal parts of slaked lime and ordinary salt. None is given for the first two weeks, then half a teaspoonful per feed for one week, gradually increasing to two teaspoonfuls per feed at five weeks.

KILLING WILLOWS WITH POISON.

"WILLOWS," Southbrook :—

Could you tell me the best way of killing willows. The roots are spoiling the garden, yet I would like the stumps left in the fence line and intend growing climbers over them. I have heard of killing trees with sulphuric acid or weed-destroyer.

The Horticulture Division :—

Willows can be destroyed by injecting a weed-killer, as you suggest, and no time for the operation is better than when the trees are in full growth. Bore holes in the trunk in a sloping direction with an auger, fill them with the chemical, and then plug them to prevent evaporation.

DRENCH FOR INTERNAL PARASITES IN SHEEP AND LAMBS.

"DRENCH," Eltham :—

Please advise which is the best drench for lambs and sheep. I think most of us use bluestone. I have occasionally found tapeworm in a sheep killed for mutton. Do these worms affect the condition of the sheep? Is it worth while drenching the grown sheep to remove them? How long do you recommend starving sheep before drenching?

The Live-stock Division :—

Bluestone solution has been shown to be both as effective and as safe for the treatment of parasitic infection in lambs and sheep as any other drug. Comparative tests have been carried out with bluestone, carbon tetracholoride, and other drugs, and the results show that no drug is 100 per cent. effective in the eradication of all intestinal parasites of sheep. In the tests the bluestone solution gave as reliable results as any other drug and is proved to be effective against the large stomach-worm. These drugs are not intended as agents to be used against the tapeworms, their use is primarily for the small round worms. Tapeworms do not appear to affect the condition of sheep, and treatment against them is not as a rule adopted, nor does such treatment appear to be warranted. The recommendation in regard to fasting sheep before drenching is a period of twelve hours. This may appear unduly long in the case of weak or emaciated lambs, when the period of fasting may be cut down to suit the case. Better results are obtained, however, when fasting for twelve hours is adopted. The bluestone solution is prepared by dissolving 1½ oz. to 2 oz. of bluestone per gallon of water. The dose varies from 6 fluid drachms for lambs to 3 fluid ounces for adult sheep. Care is necessary when dosing sheep with any fluid drench.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 18th January to 10th March, 1932, include the following of agricultural interest :—

No. 66056 : Driving-means for milking-machine pulsator ; S. Oldfield. No. 67304 : Hay-stacking appliance ; D. McL. Wallace, Ltd. No. 66053 : Testing and grading eggs ; A. Turner. No. 68180 : Shearing-machine ; J. A. Richardson. No. 68236 : Disk plough ; E. A. Davis. No. 68285 : Butter-divider ; J. Benz. No. 65654 : Deodorizing cream and milk ; Te Aroha Dairy Co., Ltd. No. 65988 : Shearing-machine comb-plate ; J. J. Bourke. No. 66133 : Wool-hoist ; J. Fairweather and W. R. Fairweather. No. 66805 : Tomato-house construction ; M. H. Hannaford. No. 68094 : Teat-cup ; C. H. Davis. No. 68427 : Producing soluble phosphate ; Phosphate Acidulating Corporation. No. 66224 : Repacking wool into bales : Abraham and Williams, Ltd. No. 66239 : Stock-feeder ; J. R. Irvine and G. Nicol. No. 66336 : Wire-coiling appliance ; T. H. Smith and W. J. Hart. No. 66655 : Spraying-apparatus ; E. Hope. No. 66731 : Cheese-press hoop ; C. N. Webby. No. 66786 : Hay-stacker ; Newton King, Ltd. No. 68238 : Cattle-controller ; H. V. Dyke.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.